

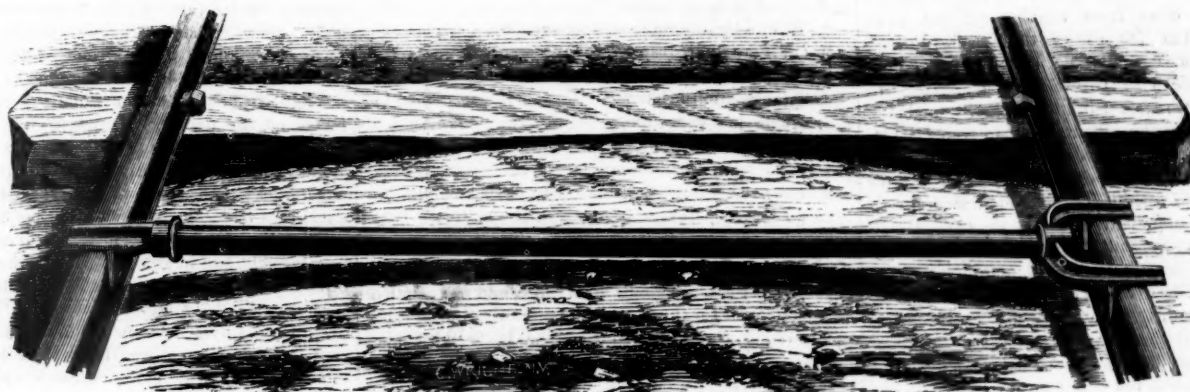


SATURDAY, MARCH 9, 1872.

## THE HUNTINGTON TRACK GAUGE IMPROVED.

This instrument has been received with so much favor by railroad track men that the proprietors of the patent have been induced to make some improvements in it to obviate the objections which have been made to the first form of construction. The object originally aimed at was to make a gauge which would always show whether it was placed square with the track on a straight line, or radial to the rails on a curve. This is accomplished by having one end forked, or double, so that it operates somewhat like a T square; that is, when both of the lugs on one end bear against the rail, the gauge will stand at right angles to it. It operates in the same way on a curve, the double end bringing the gauge radial to it. This insures greater accuracy in laying the rails, and always indicates whether the gauge is placed square or radial to the track.

The first of these gauges which were made were constructed of two malleable iron ends bolted to a wooden cross-piece. This form lacked the requisite stability for a standard gauge, the shrinkage and yielding nature of the wood making it impossible to keep it entirely accurate at all times. The engraving herewith represents an improved form of construction, in which the two malleable iron



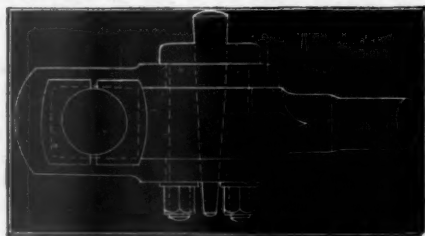
THE HUNTINGTON TRACK GAUGE IMPROVED.

ends are attached to a piece of wrought-iron gas-pipe. The latter is screwed into the castings with a tapered thread, and then fastened rigidly with a pin riveted up tight. This, it is thought, will give much greater accuracy and strength to it, and thus be better adapted to the rough usage to which such a tool must necessarily be subjected.

These gauges and further information respecting them may be had by addressing A. N. Kellogg, Nos. 63 and 65 South Canal street, Chicago; or W. H. Boardman, No. 72 Broadway, Room 7, New York.

## Improved Stub-End.

Mr. Coleman Sellers has the following note on an improvement in stub-ends in the *Journal of the Franklin Institute*. "The stub-end of which the annexed figure is sufficient explanation is designed by Mr. John Fritz, for the large engines he is making for the Bessemer plant of the Bethlehem Iron Company, at their works at Bethlehem, Pa. The cut explains itself. It may be observed that the gibs used in each side of the key are made with heads which project side-ways as well as end-ways,



and the washers and nuts at the lower end of gibs also cover as much surface on the straps as do the heads. The gibs are, in fact, through bolts, and while they answer the purpose for which they are required, they serve to bind the strap firmly to the stub-end, and prevent the looseness from wear consequent upon the use of gibs as ordinarily made. This practice of Mr. Fritz seems to have all the merit of the through bolts as used by locomotive engineers, and the gib and key as used on stationary engines."

## Contributions.

## THE SOUTHERN ROUTE TO THE PACIFIC.

NUMBER TWO.

SAN FRANCISCO, January 29, 1872.

In the first letter I followed up the supposed track of the Texas Pacific Railroad to the Colorado, at the mouth of the Concho. The road will undoubtedly continue up the latter stream, as it offers the easiest gradient of approach to the great plateau of the Llanos Estacados.

We saw no buffaloes (it was in June, and all except a few stragglers were gone to summer on the lusher prairies of Nebraska), except here and there, where some old, peg-horned gladiator slept in his indestructible skin, with his skull crushed in, perhaps; while many hundreds of weaker ones lay in the deeper ravines, where they had bogged down in the tail-end of winter, but clutched now in a hard-baked vise, and so nearly mummies in this wonderful air that I almost fancied I could see the pleading agony in their faces yet. When the July rains come, they will slowly go to decay. It seems the buffalo must suffer terribly here, before winter looses his gripe on the North sufficiently to allow them to migrate.

As it is with the cattle in the civilized portion of Texas, the buffalo are too thick. Many a man owns ten, yes twenty, times as many head of stock as he does acres; and plenty own cattle and no land. Perhaps, though, upon second thought, the buffalo are not too thick, for Dame Nature has to maintain her own *battoirs* among them, and slaughter off the old to give place for the young; hence it is the carcasses are so numerous.

be no doubt; it is dark, sometimes almost black loam, rich with disintegrated limestone.

The region along the Concho for about 125 miles is simple and unique. First, there is the vast, treeless plain, as arid and as parched-looking a desert as one can conceive; in this plain there is cut a groove, ranging from a quarter of a mile to a mile in width, about twenty feet below the level of the plain, from which it differs little in appearance, except in the larger growth of the mesquite bushes; and in the center of this groove is the Concho River. It is a very feeble creek in June, but perfectly pure and moderately cool, astonishingly full of fish (a young lady of our train caught a catfish weighing forty odd pounds), and nourishes the merest thread of forest—pecan, walnut, hackberry, wild China, etc.—noble trees, arching overhead full across the tiny stream. If this beautiful arch of greenery were cut away, in June the little Concho would suffer the fate of that foolish brook described in one of Jane Taylor's fables. This magnificent arch of dark-green, winding down through the fierce, quivering glare of the desert, is a better protection to the Concho than a Claudian aqueduct, and is remarkably full of singing birds, thus seeming to contradict Goldsmith's statement in "Animated Nature," that the feathered songsters flee from deep and solitary woods to the vicinity of human habitations.

This narrow river valley is good limestone soil, capable of bearing forty bushels of wheat per acre; and can all be irrigated from the Concho, if the protecting arch of trees is allowed to remain over the stream. It produces excellent pasturage of two or three sorts of mesquite grass, although very desert-looking when we passed;

Just on the east side of the Colorado we traversed a prairie-dog town about nine miles in diameter. He sits on his little mound bolt upright as a cucumber, the muggins; squeaks and winks with his tail faster and faster as one approaches; presently drops down so that only his blue, thin-whiskered nose and short, black, nervous tail are visible, then with a final squeak is gone in a twinkling. It is always worth while to take note of the prairie dogs, because they are an infallible sign of strong soil. They must have good grass and plenty of it, for they are insatiable as woodchucks or the daughter of the horse-leech. And when one notes the astonishing bareness and dustiness into which they have nibbled the naked plains just before the July rains come to revive them, it is a wonder how they exist in that tight season.

We should hardly have known when we passed from prairie to plain, except that the dwarfish live-oaks ceased so suddenly about nine miles east of the Colorado that there could be no mistake. The prairie dogs, too, are really occupants of the plains, and not of the prairies. The long, magnificent prairie roll, characteristic of Texas, continues till you reach the Colorado, but west of it the plains are rather level than otherwise.

Long after we left all houses of settlers we still saw the vanguard of Texan civilization, the marked and branded cattle—magnificent animals, for out here they are no longer too crowded. I sometimes felt a strange loneliness as we ventured out upon this waste and desolate edge of the world, to see these beautiful animals, else so domestic, gaze so curiously with heads high uplifted at the unaccustomed spectacle, then turn about and run for miles and miles together, without ever once stopping to look back. But even these we saw now no longer.

On either side of the Colorado the plain slopes down for many miles, with a descent so very gradual, though rolling, that I believe much of the surface could be irrigated from the river, back, say, four miles from the same. Even when feeblest, just before the July rains set in, that river has a current here, even on the rapids, four or five rods in width and a foot deep. And of the capabilities of all the lower-lying soil hereabout there can

and the cattle of the train throve notably until we reached the headwaters.

On the plain there are sometimes a thousand acres in a body as bare as my hand, with a cactus here and there; then patches mottled reddish purple, with quite a thick place of red-top mesquite grass; then tawny with the curly mesquite; lastly, green ribbons of short wild-rye, winding down through the "swales." But even here a great proportion of the soil is strong enough, being dark limestone loam, especially well adapted to wheat, grapes and olives, except that it is too far from the salt sea-air for the latter. But water—that can nowise be got except by boring wells.

Whether the buffaloes migrate north to avoid the heat, or because the grass is too juiceless, or for both reasons, I cannot say; probably the latter. Antelope live here in abundance, and even on the awful Llanos Estacados, throughout the summer, wherever there is water in the vicinity.

It is wonderful how all vegetation in this Concho region runs to thorns, as indeed it does, more or less, all over Western Texas. Of the thirteen or fourteen distinct species of bushes which I enumerated here, there is only one of any importance, called by the Mexicans *cheriondia*, which is not ferociously rigged with thorns, to say nothing of the seventy odd varieties of cactus which a post-surgeon told me he had counted up.

On the Concho, although it was only mid-June, we had a premonition of the summer rainy season, which is not due until mid-July. Several times there was that strange labor, that terrific yeasting and writhing of the elements, that awful thunder and lightning and swift scudding of black and gusty clouds, so peculiar to this semi-tropical region; yet, after all this fearful commotion, there was only a little chicken-feed of hail, invisible in the tempest of dust, and two or three times a few drops of rain, stingily wrung out of a dry heaven, and slung like bullets into the dust.

To judge from appearances, it is hard to imagine any human uses which the awful Llanos Estacados can subserve. It is a region seventy miles in width, without any water except in two ponds, which, when we passed,



were mere damp mud. The most conspicuous feature of vegetation is the *palma*, or Spanish bayonet, which, with its huge topknot of curving bayonet leaves, looks like a Comanche with an enormous head-dress of feathers; and one of our herdsmen actually charged upon the first one he saw in the soft desert moonlight, valiantly clutching his revolver. There is scarcely any cactus here; but the ubiquitous mesquite bush struggles feebly to live, while the principal fleece of the ground is composed of a greenish kind of heath, and gray tufts of buffalo grass. The prevailing color, therefore, in mid-summer is grayish-green, the gray predominating on account of the amount of grass.

And yet the soil is strong in the broad depressions of the plain, and the dry rasping clumps of grass were greedily devoured by the cattle, until, poor brutes, they were dying from thirst. We saw several antelopes in the very middle of this dreadful desert. If these Llanos have not many very positive virtues, at least they avoid the deadly sin of alkali, which curses so much of the Central and Union Pacific route. All of Western Texas which we traversed is free from it as far west as the Pecos, for the limestone everywhere in the soil keeps it sweet and clean.

Only a topographical survey and actual experiments can determine whether artesian or other wells can ever rescue this region from the possession and reign of death, which broods over it like a pall. It was not hotter in mid-June than I have felt it many a day in New Orleans or Los Angeles. If these Llanos have a future, it will be rather as an agricultural than as a grazing country, even as the great drought of 1863-4 demonstrated that every acre of Southern California (not Lower California) which is by any possibility arable were much better plowed than pastured. It is not profitable to irrigate grass, unless it can be done from running streams, as in Switzerland, on the fringes of the Black Forest, and already to a considerable extent in Siskiyou County, in the north of this State. If water can be got here by a reasonable depth of digging, there is the soil beyond dispute, and a climate in some respects better than that of Los Angeles, because it gives rain twice a year. Put on it an Italian population, such as I have seen around Naples, with their mud-walled wells every few rods, and the contemplative asses at the sweeps, lazily winding up the water, and I see no good reason why we should not get yams, and cabbages, and olives.

This region must be divested of its flitting horrors. The ghostly skeleton, the whitening bones, the ever-present and blood-chilling specter of the horrid Comanche, the appalling desolation—these things hide our eyes from the richness of the soil and the beauty of the heavens.

Again I must speak of the climate of these dreaded Llanos Estacados. During all those well-remembered days and nights while we dragged on our weary march, held back by the snail-pace of the oxen, it seemed, except for the flatness, as if we were on a mountain-top, so tranquil, so calm was the atmosphere, so exquisite the lilac tint of the heavens, so awful, so grave-like the silence when removed from the dull clamor of the train. I read bourgeois print and made entries in my journal at midnight by the light of the milky moon. When the friendly pall of darkness settled around us, hiding the abomination of desolation, and we could forget for a moment the hellish savages prowling ever in our rear, we seemed to be no longer on this hideous wild of death, but in the fabled land of the lotus-eaters.

Although the sun rode the highest meridian of the year, both men and animals moved freely on without perspiration, and, to our great astonishment, only one ox died out of all the teams on that dreadful march. The elasticity of our spirits bore us up wonderfully under the accumulated and most harassing fatigues. None but the most gentle and grateful winds, no blasting stroke of the sun—nothing but this calm and peaceful stillness, in which the wheels rolled day and night through lilac shadows. Sometimes during the night the very wagons would seem to be asleep.

Well, well, this is poetry, and yet it is fact, nevertheless. But we must not overlook the northers of winter, which are sharp and ruthless. But even California has its bitter northers. Nor must we forget the terrific hail-storms which sometimes rage here, and the merciless, swashing, beating rain-storms. The winds were here quite moderate, but on the Concho, as on the Pecos, they lasted all day, the most persistent, execrable winds, so that nobody could cook anything without digging a fire-pit.

On the western edge the plateau of the Llanos Estacados drops abruptly down 300 or 400 feet to the valley of the Pecos. Castle Mountain, which rims the plateau for several miles, is merely one of those rigid, stiff limestone ridges of which we see so many, and resembles, not a castle, but the long gray pile of the Tuileries. Through the middle of it is cleft Castle Gap, a gorge savage with that whitish color peculiar to Western

Texas, bristling with *chaparral* and wild maguay, and choked with limestone boulders, amid which the road plunges tortuously down to the plain below.

STEPHEN POWERS.

#### THE MANNER OF CARRYING ON THE UNITED STATES SURVEY OF THE GREAT LAKES.

[Paper read before the Civil Engineers' Club of the Northwest, by F. U. Farquhar, Captain United States Engineers.]

The United States survey of the lakes was commenced in 1839 under the direction of the Corps of Topographical Engineers. Previous to this time a survey had been made under the British Government by Lieut. Bayfield, R. N.

The surveys made by Lieut. Bayfield are wonderful, when we consider the means used and the short time he expended in making them. Longitude, latitude and shore line were determined by use of chronometers and sextants. His maps are practically correct, few shoals or other dangers lying on the track of commerce having escaped his observations.

It was not until 1849, however, that the United States survey of the lakes took the organization it now has. Between 1841 and 1849 the surveys had been carried on at the localities where information was most needed.

In 1849 a trigonometrical survey of the lakes was commenced and has been carried on to the present time. The surveys of Lakes Superior, Huron, St. Clair and Erie and the connecting rivers are completed. The surveys of Lakes Michigan and Ontario will be completed during the next two years.

The manner of making the surveys will be described under the following heads:

1. Minute hydrography and topography.
2. Off-shore hydrography.
3. Astronomy.
4. Triangulation primary.
5. Magnetic observations.
6. Gauging the outflows at foot of each lake.
7. Meteorological observations.
8. The projection of the surveys, or chart making.

##### L-MINUTE HYDROGRAPHY AND TOPOGRAPHY.

Under this head is comprised the work of determining the depth of water from the shore line to the six-fathom curve, or at least half-a-mile from shore, and to a depth of water sufficient for the steamers determining the off-shore hydrography to run into, so that the latter work may overlap the former. This party also makes a topographical survey of the coast and for at least one mile inland, and determines accurately the position of any prominent features of the land as seen from the deck of a vessel. The parties organized for this work consist of one officer in charge, one assistant, one recorder, one foreman, two leadmen, two chainmen, fourteen oarsmen, one cook, one waiter and one steward.

The party is supplied with at least two theodolites, (arranged for stadia measurements) one sextant, one compass, chains, pins, etc., etc., two six-oar boats, tents, and all appliances for camping out and subsisting.

A certain amount of work having been assigned to a party, they generally commence it as soon as the season will permit.

The first camp is generally pitched about five or six miles in the direction of the season's work, from its commencement, and is moved from time to time as the work progresses. As far as possible the moving from camp to camp is done by means of one of the lake survey steamers.

The first work after pitching and arranging the camp is to locate and build such stations as may be needed within the range of operations to be conducted from each camp. The stations are those used for carrying the azimuth and those used for sounding purposes.

The former are placed as far apart as the conformation of the coast will allow, so that consecutive azimuth stations are intervisible. The latter are placed from about one-sixteenth to one-fourth of a mile apart, the distance being determined by the character of the bottom, whether there are many rocks or shoals or whether the bottom descends regularly, and near the shore line presents no singularities. Should the topography of the country near the shore line permit, a small system of triangulation is also carried on as a check to other work, and a reconnaissance is always made to test the question as to such a system being practicable. As the plotting of the work is done by rectilinear co-ordinates, the axes being the true meridian of the place and the parallel of latitude passing through the place, the work on the field is made so that the computations in reducing the field notes shall be a minimum. Therefore the directions of all lines are taken with reference to the meridian, the only computations being to determine the sides of a right-angled triangle having given the two angles and the length of the hypotenuse.

The direction of the true meridian at each camp is found by the method of the greatest elongation of Polaris. The meridian having been determined, a theodolite is placed on the observation post and the axis of the telescope placed on the meridian, the left-hand vernier reading zero and the right-hand 180 deg. (that is, supposing the reading of the horizontal limb of the instrument increases to the left, and the limb graduated from 0 deg. to 360 deg.) The lower clamp being then clamped, the upper or limb clamp is loosened and the telescope is pointed to any station. After reading both verniers the instrument is carried to the station just pointed to, the limb of the instrument remaining clamped, and is set up and pointed on the meridian post, the former right-hand vernier being the left-hand. The telescope being set on the meridian post and clamped, and the upper limb unclamped, if the telescope be turned until the right-hand vernier reads zero, it is evident that the axis of the telescope will be in the meridian, so that to find the angle which any line passing through the station occupied makes with the meridian it is only necessary to keep the upper limb of the instrument clamped at the reading of the foresight to the station occupied, set up the instrument and point it back by means of this lower clamp and tangent screw on the station or meridian post, then unclamp the upper limb and point the instrument in any direction, and the reading the verniers will be the azimuth of the new direction, and so on from station to station, always taking care that in making foresights the same vernier is on the left-hand.

The checks on the azimuth work are very frequent. Where the shore is concave many stations can be seen from any one station. Now on arriving at any of these stations the instrument, after being set on the immediately preceding station, should be turned back on the farthest station, and the verniers, if the work has been done correctly, should read the same as they did on the foresight from that station when the telescope was directed on the one now occupied. The distances from point to point alongshore are measured by the chain or stadia readings. In cases such as deep bays or rivers, triangulation is resorted to, care always being taken that no angle of a triangle should be less than 30 deg. In starting a system of triangulation a careful measurement of a base is made, and in going off from it the triangles should be as nearly equilateral as possible. Where the extent of surface covered by a system of triangulation is small, a careful measurement with a well-tested chain is considered sufficient; but where the system is to extend for some distance, as along the course of a river, the base is measured with rods on a stretched rope, and as a check bases are measured every 15 or 20 miles along the river.

The topographical survey of the country within one mile of the coast line is made with a theodolite arranged for stadia measurements. This mode of determining distances and heights is, in a rough country, very much more accurate than careful chaining. An engineer skilled in stadia work can always measure distances within an error of one foot in a thousand. Then, too, this method of surveying is much less expensive than the old way of first running transit lines and following up with the level; for one person, assisted by one rodman and two axemen, can do all the work and more than a transit party and level party. Tables have been prepared by which the horizontal and vertical readings can be at once reduced without much labor. For a complete explanation of this method I would refer those interested to an article written by S. W. Robinson, C. E., formerly an assistant on the Lake Survey. It appears in the February, 1865, number of the "Journal of the Franklin Institute." It would seem that this method might be introduced with great economy on preliminary railroad surveys. This stadia work is connected with the shore-line work at as many points as possible.

The in-shore hydrography is made as follows:

If the shore of a lake is bold and the water deepens rapidly, a line of buoys is placed at the outside limit of the proposed soundings and their locations accurately determined by intersections from shore stations. These buoys are placed nearly opposite the sounding stations. Then a boat is rowed from buoys to sounding stations and from sounding stations to buoys, so that the whole space between the shore line and line of buoys is well covered with soundings. It is generally sufficient to run lines from each station to the five buoys nearest it. Should the water deepen very gradually, two lines of buoys may be necessary. The soundings are made with a marked lead line or graduated pole. They are made without stopping the boat and at intervals marked by the watch. Before the soundings are made a complete scheme of lines is drawn and given to the assistant who has charge of the work, and as each line is sounded it is marked on the sketch, thus showing at a glance what lines remain to be run. The buoy consists of a block of wood turned in a conical form and anchored by a stone attached to it by



a rope; a staff with a flag on top of it is inserted in the base of the cone. These flags are so designed of red, white and blue cloths that each buoy is at once recognized in its order by the arrangements of the colors on its flag. In the survey of a river, sounding stations are located on both banks between which lines of soundings are run.

The direction of the true meridian is determined every ten or twelve miles, and as the different meridians converge a correction for azimuth is necessary and is applied proportionately. All primary triangulation stations, off-shore hydrography and astronomical stations are carefully located by the officer in charge of the party and combined with his work. Having finished a season's work in the field, the party returns for the winter to the office in Detroit, and there makes what are called "detailed charts." In order to plot the work the co-ordinates of every station are first computed and tabulated, together with the heights above the water's surface, the origin of co-ordinates being any station. Generally, however, the zero is taken at the intersection of the rectangular axis passing through the most easterly (or westerly) and most southerly (or northerly) stations. One of these axes for each sheet is taken parallel to the true meridian on that sheet, and the other axis perpendicular thereto. The scale of these detailed charts is  $\frac{1}{100,000}$ , or about four inches to one mile. The topography is represented by horizontal contour lines at intervals of ten feet in height, the zero contour being the delineation of the shore line, forests, fields, etc., being represented by the usual conventional signs. The hydrography is represented by figures showing the depth of water at each point, the character of the bottom being written as rocky, clay, sand, etc.

#### II.—OFF-SHORE HYDROGRAPHY.

Under this head is included the hydrography of the lake beyond the soundings of the in-shore parties. The work usually is done as follows:

Two observers are placed at stations on shore about six miles apart. A steamer then runs out from the shore in a direction at right angles with general bearing of it. In water under thirty fathoms deep the lead is cast every  $7\frac{1}{2}$  minutes (the steamer moving about six to eight miles per hour), the position of the steamer being observed by the shore observers every 15 minutes. The steamer runs out to about twelve miles from the shore, then runs parallel to the shore for about three-fourths of a mile, and then heads in, sounding at regular intervals. The moment of sounding is indicated by a signal from the steamer, so that the observers on shore have always a means of correcting their time. Should any shoal be found, it is carefully located from shore. This is done by setting up, if possible, two stations on the shoal. These stations are located from the shore, and the distance between them computed. The line between these stations is then used as a base from which to locate a sufficient number of buoys. A sextant is used for this latter triangulation for measuring the angles at the buoys. After the buoys are located, the shoal is covered with a network of soundings on lines between buoys and stations. In quiet weather lines of soundings are run from shore to shore of the lakes. The steamer starts from opposite some known point on one shore and steers a course, and the point on which the vessel heads when she sights the opposite shore is also located. The first and last soundings are located by means of double sextant angles taken from the steamer to three or more known points on shore. The intermediate soundings are made at equal intervals of time.

The deepest soundings on the lakes were taken just north of Copper Harbor, on Lake Superior, where a depth of almost 1,000 feet was found.

In addition to the above-described duties, each steamer is generally charged with the duties of moving and supplying shore and other parties, and all such reconnaissances as may be necessary to properly locate astronomical and triangulation stations. There are three steamers owned by the United States engaged on the survey. Others are chartered. The complement of a steamer consists of 1 assistant in charge, 1 sub-assistant, 2 recorders, 1 master of vessel, 1 mate, 2 engineers, 4 firemen, 1 carpenter, 2 wheelmen, 2 leadmen, 14 seamen, 2 cooks and 1 steward.

#### III.—ASTRONOMICAL OBSERVATIONS.

These consist in determining the latitudes and longitudes of different points on the lakes' shores, for the purpose of checking the work of the shore parties and giving a geographical location to various points.

The method used for determining latitude is by means of the measurements of the differences of meridional zenith, distances of two stars on different sides of the zenith, the instrument used being the zenith telescope.

In determining the longitude of certain places, use was made of the telegraph. In determining, for instance, the longitude of Marquette, Mich., the station near Marquette was placed in telegraphic connection with the observatories at Chicago and Ann Arbor, and in the circuit

was placed a clock and chronograph. On the cylinder of the chronograph was recorded every second beat of the clock, so that every second of time was represented by a space on the cylinder. The rate of the clock having been carefully ascertained, a set of stars were prepared to be observed by each observer on each night. As each star crossed the wires of the transit at Ann Arbor, the observer touched the key and the instants were recorded on the cylinder of the chronograph. When the same star crossed the transit wires at Marquette and Chicago, the times of transits were also recorded on the same chronograph. The true difference of time between culminations of the same star at the stations was the true difference of longitude. The difference as observed was recorded on the chronograph and was measured with great nicety, and when the proper corrections for observation and rate of the clock were applied, the difference of longitude was ascertained. The longitude of the observatory at Ann Arbor has been determined in so many ways that it was a very good initial point to work from; and as the longitude of the observatory in Chicago was equally well known, it formed a good check on the system. These observations of stellar culminations were continued for a series of nights, and thus the longitude of the station at Marquette was determined very accurately. In a similar manner in connection with other well-known observatories the longitudes of Detroit, Milwaukee, Buffalo, Oswego and some other points were determined.

Now from Marquette there was no telegraph to use in determining the longitude of other points to the eastward on Lake Superior. So resort was made to flashing powder at some point visible to Marquette station and the next station occupied to the eastward. Now it is evident that if the observers at each station noted carefully the local times at which they observed the same flash, the difference of local times was the difference in longitude. At an agreed time, generally between 10 and 11 p. m., flashes were made in sets of ten. Both before and after the time of flashing observations were made on transit passages of stars to carefully determine the errors of instruments and chronometers. After enough observations were made to determine the difference of longitude between Marquette and the first station to the eastward, the Marquette party was transferred to another point still more to the eastward, and the flashing party was also transferred to some point visible from both stations; and so on, the longitudes of points about 20 miles apart were determined. The latitude was carefully determined by means of observations with zenith telescopes. From each astronomical station a connection was carefully made with one or more stations of the shore parties. The geographical positions of the various stations thus determined act as a check on the shore-line work, and serve also to project the surveys on charts. If the direction of a shore-line is nearly north and south, as in Lake Michigan, the shore-line work is checked by means of latitude and azimuth determinations. Stations are placed on prominent points and the latitude of each carefully determined, and the angle between the meridian at each station and the lines joining the station with the stations to the north and south of it measured.

Thus there is obtained the necessary data for solving the right-angled spherical triangles. And having the longitude of one or more stations in the chain (in the case of Lake Michigan the longitudes of Green Bay, Milwaukee, Chicago, Michigan City, and probably Grand Haven, were determined by means of telegraphic connection with well-known observatories), the longitude of any azimuth station is easily computed.

The azimuths to each station are determined by careful theodolite measurements.

The complement of each astronomical party is one assistant in charge, one recorder, one cook and five laborers; each party is supplied with one portable transit or meridian circle, one zenith telescope, one theodolite, chains and pins, etc., and such tents and supplies as are necessary in camping out.

#### IV.—PRIMARY TRIANGULATION.

A still further check on the work is afforded by covering the lakes with a network of triangles. At present there are two systems projected, one covering Lake Superior and one covering the north end of Lake Michigan and the Straits of Mackinaw. It is hoped that the two systems may be connected on a line common to both.

The Lake Michigan system was commenced by measuring a base on the south shore of the Straits of Mackinaw, near McGulpin's Point, of about 20,000 feet. By means of the Manitou Islands and the north shore of Lake Michigan a very handsome system was obtained and carried over to Green Bay and tested on a base measured on Chambers' Island. The Lake Superior system was commenced by measuring a base in Keeweenaw Bay about 29,000 feet long, and from it was developed a system covering the whole lake.

The manner of making a primary triangulation may

be divided into three parts: 1st, the location, preparation and measurement of the base line; 2d, the reconnaissance for and building of stations, and 3d, the measurement of the angles of the several triangles comprising the system; and each part will be described in the following description of the manner of conducting the primary triangulation of the Lake Superior system.

1. The base and system were approximately located from an examination of Bayfield's chart of Lake Superior, and reconnaissances were made of the localities, and points were found on each side of the Keeweenaw Bay that could be used in developing the system, of which some of the lines measured over 100 miles in length. A line was found near the head of Keeweenaw Bay on its west side, which in length and direction was favorable for the base. It was definitely located, and stations built at its extremities. A cutting through the timber 100 feet wide (50 feet on each side of the line) was made. The line was carefully graded, tamped and drained for a width of  $7\frac{1}{2}$  feet on each side, all the loose soil, roots, etc., having been removed. No gradient was more than three degrees in inclination. After the line was thus prepared, a stone post five feet long was sunk into the ground under the center of one of the stations already built. The top of this stone was about two feet below the surface of the ground, and on it was fastened a brass block, on whose upper surface were two lines crossing each other, their intersection being exactly under the center of the station.

#### 1. The Measurement of the Base.

This was done by using what is known as the compensating base-measuring apparatus. The apparatus consists of two tubes of sheet iron, in each of which are suspended two bars, one of iron and one of brass. These bars are rigidly connected at one end with each other, and at the other are connected by a lever so arranged that the end of the lever is always at the same distance from the fixed ends of the bars, no matter what may be the expansion or contraction of the bars in consequence of changes of temperature. Through one end of the tube projects a fixed contact quill, with a head whose surface is the segment of a sphere whose radius is the length of the tube, and at the other is an adjustable contact quill furnished with a Bessel's contact level. The tube is also furnished with a level and vertical limb to show the angle that the rods make with a horizontal plane.

There are three well graduated thermometers attached to each tube. The tubes are supported on two trestles, one having three legs and the other two. Both trestles are furnished with lateral, longitudinal and vertical fast and slow motions, and are set on iron bed-plates. The lengths of the tubes used are carefully determined by comparison with a standard bar, whose absolute length at 62 deg. Fahrenheit, and its rate of contraction and expansion for a change of temperature of one degree, are known. This comparison is made very often during the measurement of the base, in order to detect any change in the lengths of the tubes arising from want of true compensation or any derangement of the bars. The comparisons are made with a Bessel comparator reading to the  $\frac{1}{100,000}$  of an inch.

In measuring, the tubes, as they are placed one in front of the other, are aligned by means of a theodolite placed on the line. The work of measuring is one of great labor and care. To measure the line the first thing that was necessary was to bring the rear end of the first tube over the initial point. The rear agate of the first tube was brought in contact with a silk plumb-line suspended from the center of the station, the point of the bob (of about 5 lbs. in weight) being over a point in the top of the small brass piece leaded into the top of the stone. A theodolite was placed on the line about 1,000 feet from the starting point. The intersection of the cross hairs was brought on the initial point; the telescope was then elevated, and the agate of the front end of tube brought into the intersection of the cross hairs. The first tube was then in place. The second tube was then brought up and aligned, and contact made with the first tube. The first tube was then moved to the front of the second, and so on. The notes taken for each tube were the time of making the observations, number of tube, counting from beginning of measurement, number of tube (1 or 2), readings of the contact level, inclination of the tube to the horizontal, and readings of the thermometers. The direction and force of the wind were also noted, together with the condition of the line, weather, &c. The end of each day's work was marked by a stone similar to that placed at the commencement of the work.

The intersection on the brass piece on top of the stone was found by using two carefully-adjusted theodolites, one placed at right angles to the line and about 300 feet from it, and the other on the line and in front of the tube. Both telescopes were directed on the agate point of the last tube and then turned down on the stone, and the intersections



of the lines of sight on the brass plate accurately marked the end of the day's work. The measurement was taken up the next day by the same means. After the measurement was complete, the length of the line was computed from the notes. It is thought that a base six miles long should be measured within an error of an inch.

2. While the base line was being prepared for measurement, a party was busy reconnoitering for and building stations on all proper points to be occupied as vertices of the several triangles. In locating the stations care was taken that no angles should be less than 30 deg. and that the system should expand gradually. In the Lake Superior system there are very few angles under 40 deg. In addition the station had to be on such high ground that a line joining any two vertices of a triangle should not cut the surface of the earth. Nothing but the most extraordinary refraction allowed the completion of the system on Lake Superior.

3. As soon as as many stations were built as could be used during the season, the reading of the angles commenced. Theodolites having from 12 to 16 inch limbs, reading to 5 sec. were used. The angles are now being read by instruments reading to 1 sec. by means of micrometer attachments. A large number of measurements of each angle are made and a mean taken. After the sides of the triangles expanded to more than 28 or 30 miles the stations were often not visible from each other. A heliotrope was then used at the station looked at. But after the lines expanded to more than 60 miles the ordinary heliotrope failed, and small looking-glasses (10x12 inches) equatorially mounted were used. During a bright day the reflection of the sun's rays from one of these glasses was distinctly seen for more than 100 miles. By means of cutting off the light for unequal intervals, telegraphic messages were frequently sent over lines more than 90 miles long. The reflected light from these mirrors was thrown in the right directions by means of a screen, having a hole through it a very little smaller than the mirror. The centers of the mirror and of the hole in the screen were placed on the line joining the two stations, and when the edges of the hole in the screen were equally illuminated, the attendant knew the reflected light was directed on the other station. The parties making the measurement of the angles of the great triangles also determined the latitudes and longitudes of the vertices.

Now after the determination of the length of the base the computations of the triangles commenced. In all cases there were at least three angles and one side given to determine the other two sides. To test the accuracy of the triangulation a base of 22,000 feet has been measured on Minnesota Point, at the west end of Lake Superior, and this base will form the side of one of the triangles of the system.

#### V.—MAGNETIC OBSERVATIONS.

These observations are usually made by the astronomical parties, and consist in determining the dip and declination of the needle and the magnetic intensity at each point occupied by the astronomical parties. The instruments used are the declinometer and dip circle.

#### VI.—GAUGING THE OUTFLOW OF THE LAKES.

Parties were stationed on the St. Mary's River, below the falls, the St. Clair River, the Niagara River and the St. Lawrence River. The following is a description of the mode of gauging the St. Clair River.

The St. Clair River at the place chosen was about 1,700 feet wide. A base line 700 feet long and parallel to the axis of the current was chosen, and at its extremities posts were sunk into the ground for the theodolites to rest upon. Near each of these posts was placed another post, on which were a relay or sounder and a talking key, and at one extremity of the line was placed a chronometer. The two extremities of the base line were then connected with a wire and small battery. On the opposite shore two flags were set up so that the lines joining them and the opposite station of the base line should be perpendicular to the direction of the current.

Then a float being set off at any desired distance from either shore from a boat anchored far enough above the upper station to allow it to assume a uniform motion, the assistant at the upper station directed the telescope of his theodolite on the opposite flag. Just as the float reached the field of his glass he gave an alarm with his key and caught the beat of his chronometer. Then, with his hand on the key and counting the chronometer beats, he watched until the float reached the vertical cross-hair of his telescope, when he closed the circuit and recorded the time of passage. The assistant at the lower station at the first alarm turned his telescope upon the float and followed it until the single tick showed him that it had reached the upper line; he then read and recorded the angle, and then turned his telescope upon the lower flag. He in turn, as the float approached the line, gave the alarm and single tick as it passed, and the first assistant at the alarm turned his telescope upon the float and counted the chronometer beats until

the tick told him that it had passed the lower line, when he noted the time and recorded it together with the angle. Both the angles were read from the direction of the base line.

In this manner the times of passage of the float across the lines joining the stations and flags were obtained to the nearest second, and the place of passage within a foot. After a series of floats had been put out at different depths, the boat was moved to another position farther from or nearer to the base line, and another series taken.

The lower part of the float was an old paint keg with the bottom knocked out and with a reel inside of it with as much small cord as was necessary wound upon it. This cord was marked every five feet and passed up through a small hole in a leather strap riveted on the top of the keg.

The upper part of the float was made of tin in an ellipsoidal form. Through its axis was run a wire, projecting below about four inches, at which end was attached the cord joining the upper and lower float, and above about eight inches, at which end was fastened a small flag two inches wide and six inches long. By lengthening or shortening the cord joining the upper and lower floats, the velocity at different depths of the stream was ascertained.

The cross-sections of the river at the upper and lower stations were carefully determined by means of careful soundings on the lines joining each station and its opposite flag, the position of each sounding being carefully located by intersections from the base station.

During the time the parties were engaged meteorological observations, including the height of water, were carefully taken every two hours.

A system of vertical planes parallel to the base line 200 feet apart were conceived to pass dividing the river into divisions. The divisions nearest the shore were again subdivided. The mean velocity in each division was then computed from the field data. The discharge in each division per second for any day was the product of the mean of the upper and lower areas of each division by the mean daily velocity of the current in that division, plus or minus the correction of height of water for each day. Adding together the discharges of the several divisions, the result was the discharge per second of the river for that day.

Knowing the area of country drained into a lake and ascertaining by observations taken at a sufficient number of points within that area the amount of rainfall over the area and the amount of discharge at the outlet of the lakes, many useful problems may be solved, if the observations be kept up for a length of time.

It is estimated that about one-fourth of the rainfall is absorbed by the vegetation and another one-fourth evaporated before it reaches the outlet of the lakes, leaving about one-half of the rainfall to be discharged at the outlet of the lakes.

#### VII.—METEOROLOGICAL OBSERVATIONS.

These are conducted at various stations on the lakes, and consist in observations with the barometer, thermometer, tide gauges, wind gauges, evaporators and rain gauges. In some cases the tide and wind instruments are self-registering. These observations are reduced and tabulated. One of the results has been the ascertaining of the existence of tides of the same nature as those on the ocean. As these observations increase and are carefully digested and compared with like observations at other points, there will doubtless be many interesting problems in natural science determined. The daily heights of water as shown by the tide-gauges serve to reduce all the hydrography of each lake to a reference to one plane.

#### VIII.—CHART-MAKING.

After the in-shore and out-shore parties have mapped their work, the detailed maps, together with the computed results of the astronomical and primary triangulation work, pass into the hands of the draughtsmen whose duty is to reduce and combine them. In making the final charts, the draughtsmen first determine the middle meridian and parallel of latitude. The projection is then made on the surface of a cone tangent to the earth's surface along the middle parallel of latitude. The cone is then developed on the plane of the paper. The meridians appear as right lines, and the parallels of latitude are arcs of circles. The scales on which the maps are made are, for charts of whole lakes,  $\frac{1}{100,000}$ ; for localities such as large bays,  $\frac{1}{50,000}$ ; for harbors, etc.,  $\frac{1}{25,000}$ ; and for rivers such a scale as will give room for showing all bars, etc., plainly. On each chart is given, by lines and by precepts, sailing directions; and, as the soundings written on the maps are all referred to the same plane, a water table is given, showing the heights of water referred to this plane during the season of navigation for a series of years. The variations of the magnetic from the true meridian for the various localities on the map for the years in which they were determined are also tabulated, and if any periodical change of variation has been ascertained, this also is recorded. Thus it will be seen that

the information gathered by all parties is in some form or other finally recorded on the final charts of the lakes.

When one comes into possession of one of these charts of any of the Great Lakes, he little imagines the amount of labor and expense the government has been to to furnish a sure guide for the mariner.

#### About Car Heaters.

The regular annual harvest of roasted railroad passengers has just been gathered, and, although the victims were not so numerous as on former occasions, the horrors of this class of calamities thus far reported are fully up to the standard. It is sickening to read the accounts of these disasters, and the more so from the fact that it seems that roasting people alive in a wrecked train can be avoided. At all events there is heating apparatus in use on some roads that is far superior to coal or wood-burning stoves, and safe in case of accident. There does not seem to be any reasonable excuse for any railroad not being provided with some of the improved heating devices, inasmuch as the expense is but a trifle above the ordinary stoves. Some of these contrivances give a uniform heat throughout the car, rendering all the occupants comfortable alike; while the coal or wood-burning stoves make some uncomfortably warm while others are suffering from cold. Add to this the certainty of setting fire to the train in case of even a slight accident, and you have sufficient reason for abandoning the use of stoves for car-heating entirely.

One manager of a railroad gives as a reason for not adopting "an improved safety heater" that the company cannot afford it. It is now well supplied with the most approved wood-burning stoves, and it would be a waste of money to lay them aside for something else more expensive.

Some others who have had a sadder experience might have saved several lives and their company thousands of dollars by expending a trifling amount for some of the well-tested and highly approved heating apparatus. Several contrivances for this purpose have been patented, and some of them are worthless or at least have little to recommend them, and it is the persistent efforts of the owners or agents of this class of inventions to force their wares into the notice of officials that breeds a contempt for all patented articles.

There are, however, some improvements in car-heating apparatus of sufficient merit to entitle them to the consideration of every railroad superintendent in the land. It is obviously improper here to discuss the merits or demerits of any particular device for heating cars that has yet been brought out, but it may not be amiss to say that *no car is safe with a stove in it.*

Heating with exhaust steam is objectionable, and taking steam direct from the locomotive boiler is far more so. Whatever device for heating is employed, it should be independent of the locomotive, the reason for which will be clear to any one who will give it a little thought. There should be fire in only one car on the train, and that car, or as much of it as necessary, may be made fire-proof, so that in case of accident fire would not be communicated to any other part of the train.

Most railroad companies expend money liberally for the convenience, comfort and luxury of their passengers, and after having done this they inform the public of what they have done for them. This is done at an enormous expense in advertising, and the people are highly gratified to learn that so much has been done for their comfort. Doubtless, however, if they were informed that "our cars are equipped with the improved safety heaters," they would be more pleased than to learn of full-length mirrors and heavy carvings, gilt moldings, etc., provided at an enormous expense. Of course no one has any objections to riding in a coach luxuriously furnished at an expense to the company of twenty-five thousand dollars, if the company can afford it; but, on the whole, the traveling public would be better pleased to see a portion of the money that is expended for useless, gaudy trappings appropriated for means of greater security to life and limb. It is not expected that the expenditure of any amount of money would prevent an occasional accident from a defective rail, wheel or axle, and like causes; but the crowning horror of winter accidents (that of roasting people alive) may be prevented. Railroad managers have of late taken a more lively interest in the safety of passengers than formerly, and travel by rail is regarded as far more safe than it was a few years ago. There is abundance of evidence that a general reform in railroad management has been commenced, and its beneficial effects are already apparent. Substantial iron bridges are fast taking the place of rickety wooden ones; heavy steel rails are being put in the place of iron of an inferior quality. In safety couplings and platforms, atmospheric and other safety brakes, improved wheels, axles, trucks, and, finally, through the whole chapter of railroad machinery, a



vast improvement is visible. A great many lines are laying double tracks with first-class material and workmanship. Abundance of rolling stock is being provided from the best shops in the country. The rapid increase of traffic creates a demand for this extra rolling stock; but it is noticeable that none but the best is called for, which is good evidence that the railroad management have an eye to safety and economy.

If more attention was paid to ways and means of preventing this most horrible of railway accidents, the public would certainly feel grateful.

WM. S. HUNTINGTON.

#### Single-Rail Railroads.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your number of February 24, 1872, you describe and illustrate a plan for a "one-rail railroad." Inclosed is a copy of a letter I sent to the *London Building News* January 19, 1872, in which paper the plan was published. The idea is an old one, Mr. Joseph Dyer, of Melbourne, having endeavored since 1857 to get the Victorian and New South Wales Government to give it a trial.

I remain, sir, yours truly,

JOHN BLACKBURN, C. E.

[COPY OF LETTER, "BUILDING NEWS," JANUARY 19, 1872.]

SIR: I have just seen a copy of your journal dated December 8, in which you illustrate and describe in detail a "one-rail railway," the idea being claimed by Mr.

"In the above arrangement there is introduced what I call a cushioned crown-plate, with a center spring. The other two-thirds of the weight is carried on the outer springs. They all work harmoniously together, and the load is thus carried more steadily than on other trucks. The springs are perfectly secured, so that they will always remain perpendicular when in running order. The king-bolt passes through the center of the middle spring, thus giving greater security. The crown-plate has a conical or rather ball-and-socket seat which allows the greatest freedom of motion.

"The weight of the car is carried on the outer springs by swinging links, so as to allow it to turn on the truck with the greatest ease, on the same principle as the freight car truck (illustrated in the *RAILROAD GAZETTE* of Jan. 30). On the left side of the transverse section the springs, links and spring seat are shown. The latter has a guide cast on it to receive the spring and to prevent its being swayed over by the load. The only lateral play which the truck has is that which is allowed between the flange of the wheel and the inside of the rails. By this arrangement all the side levers, jaws for the movable boxes, outside springs, swinging bolsters, friction plates, etc., are dispensed with, and the load is at the same time carried with ease and safety.

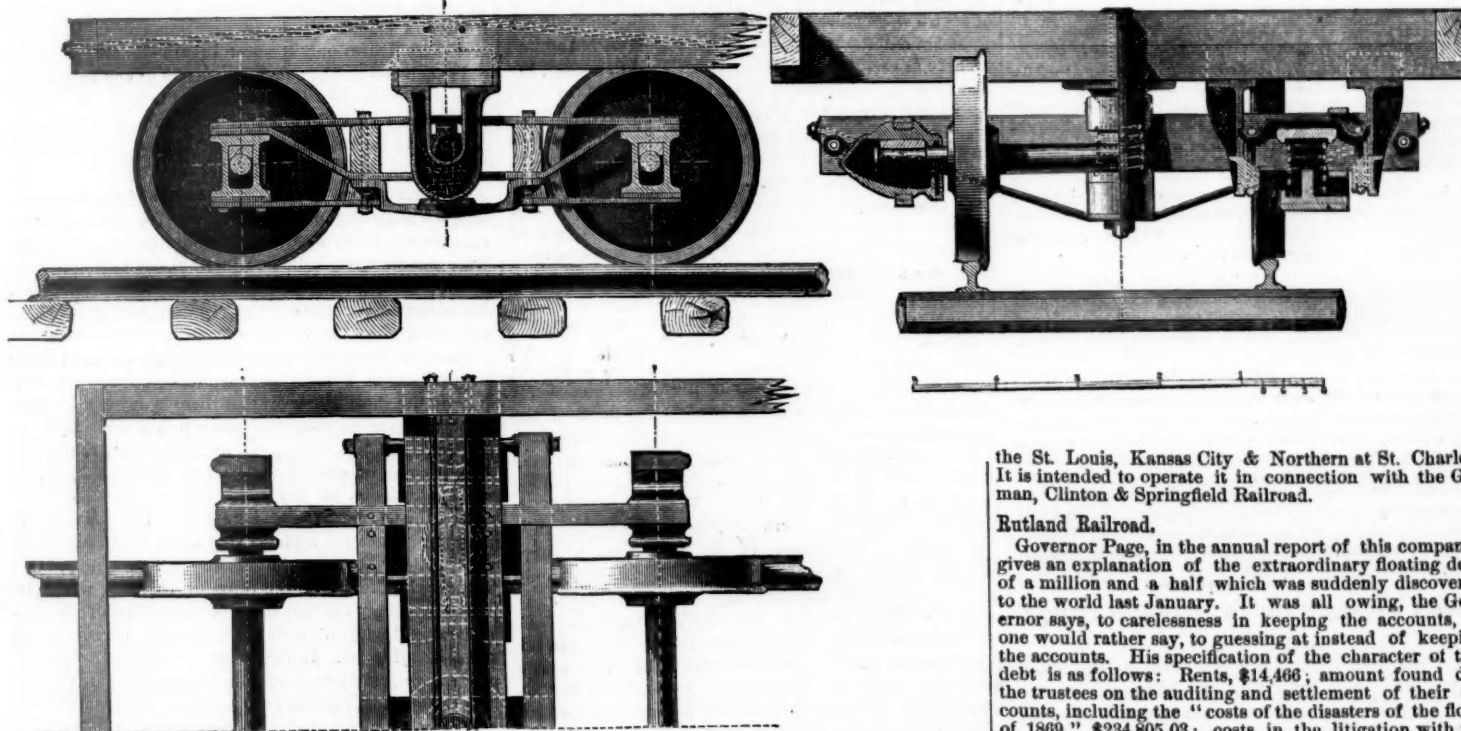
"In case the truck runs off the track, either from a broken rail, misplaced switch or other cause, the above arrangement of suspension links and brackets will hold the trucks parallel to the car, and it will thus run for

Edmund Belch, Cole County, Mo.; J. H. Nash, Cass County, Mo.; Nathan H. Parker, St. Louis. The proposed route is on the north bank of the Missouri from St. Charles to Jefferson City, and thence west by south to Fort Scott, for about 70 miles from Fort Scott being not more than 12 miles from the Sedalia Division of the Missouri, Kansas & Texas; thence to Jefferson City between the Missouri Pacific and the line on which the Missouri, Kansas & Texas proposes to construct a St. Louis outlet, and nowhere more than 25 miles from either, or 10 miles from one of them; and from Jefferson City to St. Louis within 10 or 15 miles of the St. Louis, Kansas City & Northern, except for about 40 or 50 miles east of Jefferson City.

#### Springfield, Carrollton & St. Louis.

Certificates of association of this railroad company were filed with the Secretary of State of Illinois on the 29th ult. The capital stock of the company is \$1,500,000, divided into fifteen thousand shares of one hundred dollars each; the principal office of the company is to be located at Carrollton, Green County. The directors are: Hon. John T. Stuart, Dr. S. H. Melvin, Hon. Wm. M. Springer, Geo. N. Black and F. J. Carter, Springfield; Hon. John Ruyle, Athensville; Jacob Bowman, L. S. Eldred and H. L. Clay, Carrollton; James H. Belt, Fieldon; Hon. Wm. H. Allen, Grafton. By a direct line the route of the road from Springfield will pass through Lomax, Waverly, Scottsville, Allensville, Wrightsville, Dover, Carrollton, Fieldon and Grafton, the route to Carrollton being due southwest and thence to Grafton due south. Grafton is on the Mississippi about 20 miles above Alton and just at the mouth of the Illinois, and but 12 or 15 miles nearly due north of St. Charles, Mo. To reach St. Louis it is proposed to use either a projected road down the east bank of the Mississippi or to construct a line from the Missouri shore opposite Grafton to

#### WILSON'S IMPROVED PASSENGER-CAR TRUCK.



Haddan. The plan is a very old one. When I was in Melbourne in the beginning of last year (1870), I met Mr. Joseph Dyer, who showed me a model of a railway he proposed as far back as 1857, a description of which he published in that year's December number of the *Sydney Magazine of Science and Art*. Except that your illustration shows a roof and cushioned seats to the car, it is an exact copy of the model which, I believe, is still to be seen in the Melbourne Exhibition Building. If Mr. Haddan will refer to *The Engineer* for February 24 and March 7, 1871, and the Melbourne *Argus*, December 14, 1870, and April 13 and 14, 1871, he will find letters from Mr. Dyer and myself relating to this plan of railways. The *Argus* can be seen at Messrs. Gordon & Gotch's, in Holborn. I am, &c., JOHN BLACKBURN.

Cairo & St. Louis Railroad, St. Louis, Missouri,  
December 30, 1871.

#### Improved Passenger-Car Truck.

The engraving above represents a truck designed and patented by Mr. Thomas L. Wilson, of Toronto, Canada. Our illustration represents this invention as adapted to a 3 ft. 6 in. gauge road. The following description is given in the language of the inventor:

"On all passenger car trucks there is always an arrangement by which the car body can have a lateral movement on the truck. This causes an unpleasant motion at times and produces sudden jerks which have a tendency to spread the rails.

considerable distance on the road without serious injury to the car or passengers.

"Of course, any other kind of springs could be used on a truck of this kind, as the arrangement is not confined to the use of the 'reverse spiral springs.'"

#### OLD AND NEW ROADS.

##### Hempfield Railroad.

A route has been surveyed for an extension of this railroad from the present terminus at Washington, Pa., eastward to a connection with the Pittsburgh & Connellsville road. An examination is to be made also of the old line, on which a considerable amount of work was done some years ago, and it is intended as soon as the route is selected to commence construction.

##### Fort Scott, Jefferson City & St. Louis.

Articles of association of this company were filed with the Secretary of State of Missouri on the 28th ult.

The articles affirm that the company shall construct a road from St. Louis to Vernon County, Missouri, a length of 270 miles; the road running through the counties of Vernon, Bates, St. Clair, Henry, Benton, Morgan, Monticau, Cole, Callaway, Montgomery, Warren, St. Charles and St. Louis, passing by or near the towns of Pleasant Valley, Papinsville, Lincoln, Versailles, Simpson, Coal and Gold Mine, Russellville, Jefferson City, Portland, Bridgeport and Hamburg. Capital stock of road \$4,000,000, divided into 40,000 shares of \$100 each. The directors are: L. D. Saxton, Philadelphia; T. L. Wilson, Kansas; J. L. Wilson, Pleasant Valley, Mo.; W. A. Newton, Bates County, Mo.; Ephraim Ewell, Vernon County, Mo.; C. G. Waite, Leavenworth, Kas.; James L. Brand, Vernon County, Mo.; Thomas J. Simpson, Monticau County, Mo.; James A. Spelback, Morgan County, Mo.; H. Clay Ewing, Cole County, Mo.;

the St. Louis, Kansas City & Northern at St. Charles. It is intended to operate it in connection with the Gilman, Clinton & Springfield Railroad.

##### Rutland Railroad.

Governor Page, in the annual report of this company, gives an explanation of the extraordinary floating debt of a million and a half which was suddenly discovered to the world last January. It was all owing, the Governor says, to carelessness in keeping the accounts, or, one would rather say, to guessing at instead of keeping the accounts. His specification of the character of this debt is as follows: Rents, \$14,466; amount found due the trustees on the auditing and settlement of their accounts, including the "costs of the disasters of the flood of 1869," \$234,805.03; costs in the litigation with the first trustees (not including the second trustees' cost of \$93,134.70, paid and charged in their accounts as allowed), \$106,525.59; interest on moneys paid Cheever & Hart to 1st February, 1871, under the "stipulation" for more time than given in the "mandate for decree," \$88,412.53; dividends paid on preferred stock by vote of directors, \$440,943; Burlington Steamboat Company, \$230,196.51; wharves and basin built at Burlington, \$113,057.87; Addison Railroad, \$181,183.91; interest account from July, 1868, to December 30, 1871, \$159,846.59.

##### Detroit, Fort Wayne & St. Louis.

Articles of incorporation of this company were filed with the Secretary of State of Indiana on the 19th ult. The route named is from Kokomo, at the junction of the Indianapolis, Peru & Chicago with the Chicago Branch of the Pittsburgh, Cincinnati & St. Louis, northeastward in the direction of Adrian, Mich., passing through Huntington and Fort Wayne, the length in Indiana being about 95 miles. The capital stock is placed at \$1,000,000, and the officers are: President, A. P. Edgerton; Vice-President, John Roche; Treasurer, Charles McCulloch; Secretary, Wm. Fleming.

##### Franklin & Rochester.

A strong effort is being made to secure means for the construction of this railroad from a junction with the Northern Railroad of New Hampshire at Franklin eastward through the towns of Tilton, Belmont, Gilmanton and Barnstead to Alton, about 24 miles.

##### Nashua & Rochester.

There is a debate as to which route this road shall take—one by way of Londonderry, Derry, Chester, Raymond, Nottingham, Deerfield and Northumberland, or one through Windham, Hampstead, Sundown, Danville and Tremont. The latter route is estimated the cheapest by about \$50,000, but the towns on the other are about twice as wealthy, and are likely to afford a better local traffic.





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A. N. KELLOGG, Proprietor.

S. WRIGHT DUNNING AND M. N. FORNEY, Editors.

W. H. BOARDMAN, Acting Publisher.

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## Editorial Announcements.

**Address.**—The RAILROAD GAZETTE will be printed for the present in New York; our printing house in Chicago having been destroyed. All communications, therefore, whether editorial or business, should be directed to the New York office. The proprietor will receive subscriptions and advertisements at his office in Chicago, Nos. 63 and 65 South Canal street, but letters should be addressed to New York.

**Correspondence.**—We cordially invite the co-operation of the railroad public in affording us the material for a thorough and worthy railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

**Articles.**—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

**Inventions.**—No charge is made for publishing descriptions of what we consider important and interesting improvements in railroad machinery, rolling stock, etc.; but when engravings are necessary the inventor must supply them.

**Advertisements.**—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

## J. EDGAR THOMSON ON THE NARROW GAUGE.

It is now a little more than a year since the RAILROAD GAZETTE first took issue with the advocates of the narrow gauge, and denied their main proposition, which was that "the dead weight of trains is in direct proportion to the gauge on which they run." For this denial we were assailed from all sides. We were denounced as "enemies of progress and civilization." It was said we "did not understand what we were writing about." We were requested "to revise our theories" if we "wished to promote the public service and add to our scientific reputation," and we fear we were regarded by the advocates of the narrow gauge as being afflicted with what Artemus Ward was in the habit of calling "pure cussedness." Being human, it therefore gave us much pleasure to find on reading the report of the Pennsylvania Railroad Company, that the President had taken the same ground in relation to this question that we have advocated. He said: "The saving in dead weight of machinery carried by one system over the other is not important, as the heavy engines and cars used upon the usual gauge (four feet nine inches) is not due to the width of the track, but to the necessity of maintaining higher speeds, and the movement of heavier loads, than is obtainable with economy and safety on the narrow gauge. The equipment now used on the narrow gauge is heavier than that formerly used upon the four feet nine inch lines."

Having pointed out so distinctly the fallacy of much of the reasoning in relation to this subject, it is the more surprising that Mr. Thomson should apparently attribute so much reduction, in the cost of narrow-gauge roads, to the possibility of using shorter curves on the one than on the other. We quote his language: "The only material advantage that the narrow gauge (say three feet) has over the broader railway is in the economy of its construction over a rough and difficult country. To

secure this economy, shorter curves, and, consequently, a longer line must be resorted to."

The idea that much shorter curves are possible on a three-foot gauge is so common, and apparently based upon such rational grounds, that with the authority of the President of the Pennsylvania Railroad Company in its favor, it will probably be difficult to uproot it. The idea that much shorter curves can be used on the narrow than on the wide gauge is always, so far as our knowledge extends, based upon the fact that the difference in the length of the inside and outside rails is greater when they are far apart than when they are near together, and that therefore the wheels will slip less on going around a curve on the one gauge than on the other—which is all true; but neither Mr. Thompson nor any one else that we know of, who has used this argument, has told us the degree of influence which this difference of rail length exercises on the resistance of trains in going around curves. In other words, we do not know that it is stated anywhere how much less power is required to pull a car around a curve of say 400 feet radius on a three-foot gauge than on a road of 4 ft. 8½ in. It is obvious that the difference in the resistance of a car on a curve and on a straight line is not entirely due to the slipping of the wheels on the rails, because if it were, then if the wheels were made loose on the axles, it would require no more power to move a car on a curve than on a straight line; whereas, with the present construction of car trucks, the resistance would obviously be greater even with loose wheels. This can be fully shown by a common four-wheeled road wagon, the wheels of which are loose on the axles. If the front axle of such a wagon turns freely around the king-bolt, and can assume a radial position, the vehicle can be moved around a curve as easily as in a straight line. If, however, the two axles are held parallel to each other, so that the front one cannot turn on the king-bolt, it will be very difficult to move the wagon in a curve, and it can only be done by dragging one pair of wheels laterally on the ground. Now, the axles of a car truck are always held parallel to each other, and cannot assume a radial position, and therefore in passing around a curve the front pair of wheels must be dragged laterally, just as a wagon must be if the axles are rigidly parallel. Under these circumstances there will be very considerable flange friction, even though the wheels are loose on the axles, so that the difference in the resistance of an ordinary car on a curve and on a straight line is not attributable alone to the slipping of the wheels on account of the unequal length of the inner and outer rails. If the axles of a car truck could always assume true radial positions to curves, and if the wheels were loose or were properly "coned," a car truck would roll as easily on a curve as on a straight line. With trucks of the ordinary construction, however, they cannot do this, and therefore the action of the wheels on a curve is very similar to what we have pointed out would be the case with an ordinary vehicle if the axles were held rigidly parallel. Or, in other words, the leading wheels of a truck must be moved laterally by the impingement of the flanges against the rails. This lateral movement will be the same on any gauge, or, in fact, on a single rail, and the friction of the flanges is dependent, not upon the gauge, but upon the angle at which they come in contact with the rails. This is governed by the distance apart or "spread" of the axles. Besides this flange resistance, which is independent of the gauge, the wheels, if they are both fixed on the axle, must of course slip to make up for the unequal length of the inner and outer rails. What we are now most interested in is to learn how much of the resistance of cars on curves is due to the slipping of the wheels—which is in proportion to the gauge—and how much to the impingement of the flanges against the rails and to other causes—which are independent of it.

There is, unfortunately, no accessible record, that we know of, of experiments which show clearly how much greater the resistance of an ordinary car is on a curve of say 400 feet radius than on a straight line; therefore we can only reach any conclusions by deduction. We know, for example, that the resistance due to rolling and axle friction alone, on a straight line, is about 8 pounds per ton of 2,000 lbs. We also know, that the adhesion of a wheel due to the friction on the rail is about 500 lbs. per ton of insistent weight, and that, therefore, it will require that amount of power to slide the wheels of a car. We will suppose now that we have a car which weighs 20 tons and we want to run around a curve of 400 feet radius. If our road is of 4 feet 8½ inch gauge, the length of the outer rail on a quadrant or 90° of a curve of that radius would be 7,584.3 inches. The inner rail would be 7,495.4 inches long, so that the wheels must slip a distance of 88.8 inches. It must be observed, too, that it is only the wheels on one side which slip, and therefore the resistance due to this cause is only that of the weight of one-half the car, or 10 tons. If, on running around the

curve, the wheels on one side could not turn at all, but would slip the whole distance, then the resistance from this cause would be 500 × 10 = 5,000 lbs. But, instead of slipping the whole distance, or 7,495.4 inches, they slip only 88.8 inches, or 1.17 per cent. of the distance; therefore the resistance due to this cause would be 1.17 per cent. of 5,000 lbs., or 58.5 lbs.

On a 3-foot gauge the length of the outer rail would be 7,568, and of the inner rail, 7,511.6 inches, and the difference 56.4, or 75-100 of one per cent. The resistance due to slipping would therefore be 37.5 lbs. The resistance due to rolling and axle friction alone would be the same on both gauges, and is about 8 lbs. per ton, or 160 lbs. for the whole car. Therefore we have for the resistance on the wide gauge 160 + 58.5 = 218.5, and in the narrow gauge 160 + 37.5 = 197.5 lbs. Now to this must be added the friction of the flanges of the wheels, an element, as we have stated before, whose value we have no data to determine. From the fact, however, that on a wide-gauge road on curves of a radius as short as 400 feet, the side of the head of the rail is cut away more rapidly than its face, it would be safe, we think, to infer that the resistance due to flange friction is fully equal to that of the sliding friction. As stated before, the flange friction is independent of the gauge, and therefore if we add to the resistances given above an amount equal to that due to the slipping of the wheels on a wide gauge, we will have for the resistance of the car on the wide gauge 277 lbs. and on the narrow 256 lbs., or 9½ per cent. more on the one than the other. This is not given as the absolute resistance, because the element of flange friction is not susceptible of accurate calculation. We give these figures only to show that the difference in the resistance due to the gauge, on curves of 400 feet radius, cannot be more than 9½ per cent. Probably it is very much less. As the radius of curvature increases, the difference in the resistance diminishes, and on a curve of 800 feet radius it is only 5 per cent.

If, therefore, we were to build a 4 ft. 8½ in. gauge road with the same alignment as one of 3 feet, the only advantage the latter would have would be that due to the difference we have indicated in train resistance on curves alone. The question, therefore, presents itself, whether this advantage—assuming that it is as great as we have estimated, which is very doubtful—is sufficient to compensate for the inconveniences which are inherent in the narrow gauge. It must be remembered, too, that it is only on the shortest curves that there is any considerable difference in train resistance between the wide and the narrow gauge. It varies from nothing on a straight line to 9½ per cent on curves of 400 feet radius. As a very small proportion of any road would consist of short curves, the aggregate advantage due to the reduction of train resistance on such curves must of necessity be very little. It must be borne in mind now, that the sole hindrance in the way of realizing what Mr. Thomson calls "the only material advantage of the narrow gauge," with the wide gauge, is this difference in the resistance of trains. If, therefore, the merits of the narrow gauge rest upon so slight a basis, there can be very little reason for introducing a change attended with so much inconvenience and promising so little benefit.

It must be remembered, too, that if very short curves are worked at considerable speed, the element of safety becomes a very important one; and in that event the argument is all on the side of the wide gauge, and it seems not only possible, but quite probable, that curves with a radius so short as to be impracticable and dangerous on a narrow gauge at high speed might be worked with entire safety if the rails were farther apart.

## Profits of a London Underground Railroad.

New York being much interested in projects for securing rapid transit up and down the city, by a railroad either above or below the surface of the streets, it is worth our while to examine into the condition, and especially the profitability, of similar lines already in operation. The underground line in London is often suggested as a model for New York, and it undoubtedly provides a safe, comfortable and rapid means of communication such as would be very desirable in New York. As to its financial success, we may learn something from the report of one of the companies (the "Metropolitan") for the half-year ending December 31, 1871, which was presented at a meeting of stockholders on the 14th ult.

At the close of that year the capital account showed an expenditure of £7,540,295 (about \$37,700,000), including £1,213,541 for "surplus land and property," which, we may suppose, should not be counted as a part of the cost of the property actually used by the company. The gross income for the last half of 1871 was £226,647, or at the rate of just about 6 per cent. upon the capital. The expenses were £79,714, or only about 35 per cent



of the income, which shows the expense of working is comparatively small, so that the net receipts were 3.9 per cent. of the capital. The dividend for the half year was at the rate of 2½ per cent., which would hardly be satisfactory in an American investment.

A striking fact in the history of this company is the constant decrease in profits in the face of a constant increase in traffic for the past five years. Beginning with 1867 the dividends have been 7 per cent. for 1867, 5½ per cent. for 1868, 4 per cent. for 1869, 3½ per cent. for 1870, and 3½ per cent. for 1871 (the entire year). Meanwhile the number of passengers carried has increased constantly and largely each year, being 42,765,427 in 1871 against 23,405,282 in 1867, an increase of about 83 per cent. And the increase in receipts has not been trifling—from £224,180 in 1867 to £396,068 in 1871 (70 per cent.); so we may infer that the traffic is carried at lower rates than formerly, and for the last year we are told that the competition of a new underground line (the "Metropolitan District") has diminished receipts materially. The average receipts per passenger on this line were two pence, and an increase of only a halfpenny in this amount would have added more than 60 per cent. to the net receipts, and made them sufficient for 7 per cent. dividends.

It may be urged that in New York there would be no difficulty in fixing rates which would yield considerably more even than 2½ pence per passenger; but, on the other hand, it will not be possible for them to obtain capital on mortgages at 5 per cent. and less, as the Metropolitan did, and the cost of operation would probably be very much greater. But New York is better situated for a heavy traffic on such a road, as it would serve nearly the whole city, and might secure a very large proportion of the entire city traffic.

The Chairman of the Metropolitan, in view of the growing traffic and in the face of the decreasing profits, expressed himself very confident that the line would in no very long time pay excellent dividends. The confidence of the public in the property, however, is doubtless best shown by the prices they pay for the shares, which were quoted in London at the time of the meeting at 65 to 66, having fallen within a year from 82½.

#### The South Carolina Railroad and the Central of Georgia.

Charleston has been severely exercised of late by a report that the Central Railroad Company of Georgia, whose lines converge at Savannah, has made a proposition to lease the South Carolina Railroad, whose lines are the chief feeders of Charleston, on terms which only very disinterested stockholders would be likely to refuse. It seems to be taken for granted that the Central Company wishes to lease the road in order to destroy its business—which is as if a man should offer an extravagant price for a house in order to burn it down. It is true that a number of the proprietors and managers of the Central road are residents of Savannah, and, doubtless, more or less interested in the prosperity of that city; but, if we are not mistaken, the stockholders in the aggregate are very much more interested in the prosperity of the railroad than of Savannah, Charleston, or any other city; and, if a greater profit was to be made by it, they would be willing to convey the freight from all their Georgia lines to Charleston instead of Savannah. But this policy requires that discriminations shall not be made in favor of any more than against Charleston, and perhaps that is what its people fear. However, Charleston is pretty sure of the traffic from the South Carolina Railroad proper, for it cannot be operated economically in connection with any other seaport; what is feared, probably, is that the traffic beyond it, in Georgia especially, which it might get, will be permitted to go to Savannah without an effort on the part of the railroad to bring it to Charleston. The South Carolina reaches a branch of the Central's system at Augusta, but it forms a very circuitous route for traffic from any of the Central's routes to Charleston. The natural connection of the South Carolina Railroad is the Georgia Railroad, with its lines to Atlanta and Macon, which, indeed, must look either to the South Carolina or the Central for an outlet to the sea; and if the Central should secure the South Carolina, the Georgia would be very much in its power and be likely to surrender to it—which, perhaps, is the meaning of the proposed lease.

Nothing seems definitely known on the subject. The report is that the Central, or its managers, have in their hands one-third of the South Carolina stock and that they offer to guarantee 4 per cent. dividends on the stock as rental; and as the stock is only worth 40, this seems a very liberal proposition, and suggests that it may be made quite as much for benefit of the holders of the one-third as for that of the Central Railroad.

#### The Rise in Iron.

The great increase in the price of iron, largely caused by the extraordinary activity in railroad construction, not only in the United States, but in Europe and elsewhere, has a noticeable effect on all new enterprises, and is exceedingly embarrassing to parties who undertook the construction of lines some months ago on the basis of the prices at that time. They now find that they must pay ten dollars more per ton than they counted on, and they are extremely fortunate if they can succeed in getting cash orders executed within a reasonable time. Many English mills refuse to accept orders to be filled before 1873, and American mills are crowded for a long time ahead, so there is no immediate prospect of a fall in prices, and anything but cash is apt to be scorned. The Belgian works, which, aside from England, are the chief manufacturers for European consumption, seem even more crowded, and some leading works have refused contracts to be filled by the spring of 1873. Tenders for Bessemer rails for German lines opened recently averaged about \$80, gold, per ton, and the lowest was about \$72, while a year ago contracts were made at \$60. On most American railroads (laid with 56lb. iron) an increase of \$10 per ton is equivalent to an addition of \$880 to the money cost of a mile of track, and in most cases to more than a thousand dollars in the capital account.

As to the cost of iron in England, a paragraph from the speech of the Chairman of the London, Chatham & Dover Railway Company, at its recent annual meeting, will be interesting. He said: "Taking the cost of iron and steel rails, which form so large an item in railway expenditure—just a fortnight ago we made our contracts for iron and steel rails and chairs for 1872. In regard to iron rails, we had to pay £10 10s. a ton, as against £6 18s. 6d. in the previous year. As regards steel rails we had to pay £13 5s. a ton, as against £11 7s. 6d.; for chairs we had to pay £5 5s. 7d. a ton, as against £3 9s. 3d." These figures show an increase in the English market (which to a great extent governs the iron markets of the world) of 44 per cent. in the price of iron rails, 16½ per cent. in the price of steel rails, and 52½ per cent. in iron chairs.

Next to the cost of new lines, the expense of operating old lines will be increased by this great rise in iron. It is not generally known, or if known is not appreciated, that a railroad is in many respects one of the most perishable of properties. Both rails and rolling stock require renewals at short intervals, many of our lines, west as well as east, wearing out iron rails in four years, and some in a much shorter period.

Since the rise in steel rails is not only proportionately but absolutely less than the rise in iron, it is likely that the companies will be more than ever inclined to adopt steel.

#### Baltimore Commerce.

In a recent address before the House Committee of Commerce, at Washington, the object of which was to prevail on that committee to recommend an appropriation of a million for the improvement of the harbor of Baltimore, Mr. John W. Garrett, President of the Baltimore & Ohio Railroad Company, claimed that Baltimore is "the most economical entrepot for foreign commerce" for Maryland, Western Pennsylvania and the entire United States south and west of these. This would leave to New York, Philadelphia and Boston, Eastern Pennsylvania, New Jersey, Delaware, New York and New England, which certainly will not suit New York and Boston merchants, and doesn't seem to suit the rest of the United States, else they manifest an unreasonable and persistent disposition not to export and import through "the most economical entrepot of foreign commerce."

But Mr. Garrett in his address gave some important facts, one of which is that since the change of gauge on the Ohio & Mississippi Railroad the average number of cars shipped daily over it from St. Louis to pass over the Baltimore & Ohio Railroad has increased from five to seventy-five.

Mr. Garrett also claims that Baltimore has advantages for the commerce of Duluth and the country beyond, which he attempted to prove by stating that Duluth is further from Chicago by lake than from Sandusky, while the latter place is 298 miles east of Chicago. But he did not notice that Sandusky is but 80 miles further from New York than from Baltimore, and that the grades on the New York route are comparatively light, whereas on the Baltimore route they are exceedingly heavy. And, moreover, freight which is moved on the lakes can be taken quite as cheaply, probably, to Erie or to Buffalo (from which return freights are readily found) as to Sandusky, and from these places it is certainly more likely to go to New York than to Baltimore. The truth is, it was hardly ingenious to compare Sandusky and Chicago as points for the transshipment of lake traffic from Duluth. Eastward bound traffic from Duluth is not likely to reach Chicago at all by lake, very little more than Detroit traffic. Chicago will have a considerable business with Duluth, but it will be either in produce which is moved eastward by rail, or in merchandise which does not go east at all.

#### Railroads in the New Jersey Legislature.

The New Jersey Legislature has a great many railroad schemes offered for its consideration; but it is reported that the successor of the United Companies seems to have succeeded to their power over the Legislature as well as to their business, and that the Pennsylvania Railroad gets what legislation it wants and prevents what it doesn't like. As instances, are given the defeat of acts of incorporation for lines said to be much desired by some sections of the State and to be obnoxious to none, but

which the Pennsylvania didn't care to have in its way—perhaps because it has leased all the roads it wants in Jersey.

A bill has been introduced for the incorporation of a company which, apparently, is to be the Pennsylvania in New Jersey what the "Pennsylvania Company" is in the West. At least the bill gives the company, which has authority for a capital of \$5,000,000, power to receive those lines from the Pennsylvania Railroad Company. How there would "be any money in" such a company does not appear. The recent report of the Pennsylvania Railroad Company attempted to comfort the stockholders by the statement that in a few years the earnings of these lines might reasonably be expected to equal the rental; but profit was not even hinted at.

A company already chartered is authorized to construct a railroad from Easton across the State to Bound Brook, and is probably to be an outlet for the Lehigh Valley road.

At one time a general railroad law was proposed, by which any one could have constructed a railroad anywhere in the State by complying with its requirements; but this seems to have met with no favor, and we do not know that it was even seconded.

A bill has been reported for a narrow-gauge railroad from Jersey City to Camden, with an extension from Camden to Egg Harbor and branches to May's Landing, Vineland and Millville; and it is said that it has a good prospect of passing, which, taken in connection with what is said of the power of the Pennsylvania Railroad Company in the Legislature, indicates that that company doesn't think that a narrow-gauge railroad would be very much in the way.

#### "A Neat Problem."

Some of our readers will recall the fact that in the GAZETTE of January 6 we propounded the following problem for the men in the Northern Pacific Railroad shops to solve: "Suppose a perfectly level and straight track a mile long, with a smooth board fence on one side close to the track, and that it were possible to put a pencil in the center of the crank-pin of an engine with driving-wheels 5 feet in diameter and cylinders of 2 feet stroke, and that the pencil would describe a line on the fence from one end to the other, how long will that line be if the driving-wheels do not slip?"

This problem the London Engineer copied with the above heading. The following solutions have since appeared in its columns:

"I beg to offer the following solution to the above problem: Let A, B, C, D, E, F, G and H, in the diagram, represent positions of the crank-pin during one revolution, and let these be taken at distances each equal to one-eighth of one revolution. Draw the straight line A K = the distance traveled over during a revolution of the driving wheel = 3,1416 x 5 ft. Divide this line into as many divisions as the circle A E H—viz., eight—and draw vertical lines through these points; now draw parallel lines as A K, H N, O G M (the line O G M being the path of the axle), and where these lines intersect, as at 1, 2, 3, 4, will be points in a curve called a trochoid; the points being taken at close intervals and joined by straight lines will give the form of a curve approximately. The distance gone over by the crank-pin during the time that the axle is advancing through a distance equal to one mile, or 1,760 yards, will be approximately 1836.6 yards. W. J. M.

"Glasgow, January 22, 1872."



"Your Glasgow correspondent, 'W. J. M.' has given you a false solution to your neat little problem of Jan. 19. The total space passed over by the center of the crank-pin in one mile run is obviously equal to the number of revolutions of the driving wheel in one mile, multiplied by the space passed over by the center of the crank-pin in one revolution. Number of revolutions of 5-foot wheel in one mile = 15,708. Now, if the radius of the crank were equal to the radius of the wheel, the path of the center of the crank-pin would be a cycloid, and the space described by the center of the crank-pin in one revolution would be 4 x 5 = 20 ft. Thus in one revolution the difference of the spaces described by the center of the axle and the center of the crank-pin would be 20 - 15,708 = 4,292 ft. But if the crank be supposed to have no radius, the difference of the spaces would be 0, the excess of space described by the center of the crank-pin being directly as its radius. So, when the radius of the crank is 1 ft. and the diameter of the wheel 5 ft., the excess in one revolution will be 5 x 4,292 = 21,460 ft., and the entire space described by the center of the crank-pin in one revolution will be 15,708 x 1,7168 = 26,948 ft. Therefore, total space in one mile run will be 17,4248 x 336.13 = 5856,99 ft."

"A CREWE WORKMAN." "The solution to 'Neat Problem,' issued by a 'Crewe Workman,' although it looks very neat, is not correct. 2-5 x 20 ft. = 15,708 ft. gives 1,7168 ft. as the excess of curve formed by the center of the crank-pin over the length of one revolution of the driving-wheel, whereas it ought to be only about .667 ft., and this .667 ft. x 15,708 ft. x 336.136 (the number of revolutions of driving-wheel in one mile) ÷ 3 gives nearly 1,835 yds., not 1952.33 yds., as by a 'Crewe Workman.' The curved path of the crank pin, 1 ft. from the center of the driving-wheel (or any other point between the center and the circumference) does not run parallel to the cycloidal line, consequently their lengths are not in proportion to their diameters. NEWPORT."

"I beg to differ with your two correspondents, 'W. J. M.' and 'Crewe Workman,' respecting the above problem. Supposing the crank-pin be fixed at a point on the periphery of a wheel whose diameter = 5 ft., the center of the axle will advance in one revolution a distance = 15,708 ft., but the crank-pin partaking of a compound motion, consisting of lineal advance and vertical rise and fall, will travel a distance equal to the circumference + twice diameter = 15,708 + 10 ft. = 25,708 ft.; and if the crank-pin be placed at a distance of 1 ft. from the center of the axle, the distance traversed by it in one revolution of the wheel = circumference of wheel + twice the diameter of path of crank-pin = 15,708 + 4 ft. = 19,708 ft.; consequently, while the center of the axle is traveling 1,760 yards in the first case, the crank-pin travels 25,708 ft. x 336.13 revolutions = 8,641,238 ft. = 2,886.41 yards; in the second case, 19,708 ft. x 336.13 = 6,624,451 ft. = 2,208.15 yards. ALPHA."

"Pontypool, Feb. 12, 1872."

It will be seen, therefore, that this problem has attracted more attention in England than in this country, as we have re-



ceived thus far but one solution of it, that of T. E. Hendricks, in the GAZETTE of February 3:

The answer given by him was.....	5,514.4 feet.
" " " " "W. J. M." was.....	5,491.8 "
" " " " "A Crewe Workman" was.....	5,856.99 "
" " " " "Newport" was.....	5,505 "
" " " " "Alpha" was.....	6,624.45 "

These cannot all be right. Who will give us the correct length of the line?

#### Meetings in March.

*The American Society of Civil Engineers.* No. 63 William street, New York. Wednesday, March 20, at 2 p. m. General J. G. Barnard will give a description of the great Dutch Ship Canal between Amsterdam and the German Ocean.

The meetings of this society are for members only.

*The New York Society of Practical Engineering.* Geographical rooms, Cooper Union. Wednesday, March 13. Open to the public.

*Polytechnic Association of the American Institute.* Cooper Union, New York. Every Friday evening, at 8. Open to the public.

LONDON experience, whatever it may indicate as to the profitability of underground city railroads, has certainly sufficiently proved their capacity for a heavy traffic. At the recent meeting of the Metropolitan Railway Company, the Chairman said that the company was then running sixteen trains per hour, and "had not arrived at the maximum power of running trains yet." Sixteen trains an hour, of four American cars each, would convey 3,200 passengers, all seated; which is not more than the street cars passing within a block of the Astor House are able to seat: but on a steam railroad the length of the trains might be doubled without difficulty at the times in the day when the traffic is heaviest. Of course, however, not all the traffic would leave the street cars for the steam cars, and the latter would be an addition to, rather than a substitute for, the existing provisions for city traffic.

One notable thing connected with the operation of the Metropolitan Railway, which it would be well for New York companies (and authorities which create companies) to bear in mind, is the effect of low fares, not on traffic solely but on profits. The Metropolitan Company has reduced its rates four several times, and each time the reduction has been followed by an increase in net earnings. At present the average receipt per passenger is only two pence. Doubtless a point may be reached beyond which a reduction would hardly increase traffic at all; for very few adults will ride for amusement on city lines: but it is as true in New York as it is in London, that a city line to have a very heavy traffic must have very low fares. There are, doubtless, thousands of people who would be willing to pay ten or fifteen cents for conveyance in a comfortable seat from the City Hall to Harlem; but the great mass of the people, those who give city lines three-fourths of their traffic, would find such fares an onerous tax, and unless the proposed city railroad shall do something to accommodate these classes—to afford the men and women of small incomes an opportunity to find cheaper homes in less crowded quarters—it will not serve the most pressing want of the community, and receive comparatively but a trifling traffic.

THERE were in 1871 ten lines of steamers plying between New York and European ports, including 105 steamships of an aggregate burden of 282,150 tons, and these made in all 645 trips from New York. Of these trips, 484 were to British ports (354 to Liverpool, 111 to Glasgow, 15 to London and 4 to Bristol), and 128 touched at British ports, so that of the whole number 612, or nearly nineteen-twentieths, gave us communication with Great Britain. Altogether these steamers gave direct communication to London, Liverpool, Glasgow, Southampton, Plymouth, Bristol, Queenstown and Londonderry in the British Empire, to Brest and Havre, in France, to Antwerp in Belgium, Christiansand in Norway, Copenhagen in Denmark, and to Hamburg, Bremen and Stettin in the North German Empire.

The following is a list of the lines whose steamers ply between New York and European ports:

Lines.	Vessels.	Tonnage.
Cunard.....	20	53,412
Imperial.....	16	36,643
Hamburg.....	9	27,187
Bremen.....	13	35,999
Anchor.....	18	30,679
National.....	12	45,982
Guion.....	8	25,245
French.....	4	12,192
White Star.....	3	11,211
Baltic Lloyd.....	2	3,600
Total.....	105	282,150

The Baltic line is to have two new steamers completed for it this year, and the Williams & Guion line has two of the largest class (4,000 tons burden) nearly completed; and four new companies have been organized, which expect to have steamers running before the close of the year. Two of these lines will ply between New York and Hamburg, one between New York and Naples, and one between New York and a Norwegian port. The new lines are to have in all 11 steamers.

LEGISLATURES can do many things, but they sometimes attempt what, to say the least, they cannot well do. As an instance, a bill has been introduced into the Ohio Legislature which provides that "when one railroad train is switched on a side-track for the passage of another, the approaching train shall come to a full stop, and be signaled that the switch is all right." Now it does not matter whether this is the best practice or not, but we object to fixing all the details of railroad management by legislation. We would not insinuate that the legislatures would not operate the railroads with vastly greater economy, safety and skill than the railroad officers do or can; but the business is a big one, and if the legislatures attempt it

we are sure that they will have little or no time for anything else, and the community would suffer for want of their care and guidance in other directions. All other business having gone to destruction for lack of proper legislation, what would the railroads be worth, even when operated with all the ability of the Ohio Legislature?

SOME years ago the Dubuque & Sioux City Railroad Company made a contract with the proprietors of the Dubuque elevator, by the terms of which the company agreed to pay one cent per bushel to the elevator on all grain shipped through Dubuque until 1875. When the Dubuque & Sioux City road was leased to the Illinois Central, the latter company found it most convenient to transfer the grain across the river without using the elevator, and when the bridge was completed the passing of grain through the elevator would have been, of course, an unnecessary delay, as the cars passed directly through to Chicago on their destination, without unloading. The elevator proprietors, however, claimed that the contract gave them their fee on every bushel of grain passing through Dubuque, whether it used the elevator or not, and their claim was allowed by the District Court at Dubuque, about a year ago, when it gave a verdict in favor of the elevator for \$57,750 damages until May, 1870. The company carried the case to the Supreme Court of Iowa, which has recently confirmed this decision and awarded \$69,000 damages, the increase being for interest and dues on shipments since the previous decision.

This interpretation of the contract may be correct, but if so it was a very absurd contract to make—for the railroad company. The effect will be, doubtless, to increase the charge on the transportation of grain from all points west of Dubuque by one cent per bushel.

SEVERAL measures have been introduced into the Missouri Legislature intended to compel the Hannibal & St. Joseph Railroad Company to repay to the State a portion of the advances made by the State to secure the construction of the road. It issued its bonds for this purpose, which the company was to pay if it could. But as usual in such cases, it didn't, and the State has had to pay both interest and principal. Now a bill has been introduced which is intended to compel the company to pay into the State Treasury \$55,000 per year and ten per cent. of its net earnings for the liquidation of the bonds. Another bill introduced instructs the Attorney-General to bring suit to collect moneys which, it is claimed, should have been paid heretofore by this company, the aggregate of which is put at seventeen millions! Moreover, it is reported that the Attorney-General will at once bring suit to compel the company to pay sinking-fund arrearages amounting now to more than a million.

It seems a little strange that it should have been only at this late date that the State should discover that it has such a magnificent debt due and collectable. With a few more like it, the State might dismiss its tax-gatherers—that is, if the debt—if it is a debt—can be collected, "which probably it can't."

PHILADELPHIA is exercised over an attempt now being made for authority to lay a track in Moyamensing avenue, to connect the great manufactory of Morris, Tasker & Co. with the railroads and the Delaware. The avenue has many fine residences, and the injury to property on it by admitting a railroad and trains would be enormous; but, on the other hand, the manufacturers say they must have a railroad connection, and if they cannot have it where they are, they must move their shops away. Now, the removal of the shops is regarded as a calamity to that part of the city, and likely to injure materially the property there, perhaps in the aggregate as much as the railroad would, though the loss would not all be on Moyamensing avenue. Probably such a proposition would meet with little favor in a commercial city; but in Philadelphia manufactories are what give value to property, as they give occupation to the majority of its residents, and in any manufacture where large quantities of heavy material are used, and where the products are heavy, a position where cartage is unnecessary or may be reduced to the minimum is often indispensable to success.

GENERAL TICKET AGENTS, or their authorized representatives, are notified by Mr. Samuel Powell, the Secretary, that there will be a special meeting of the General Ticket Agents' Association at the Galt House, Louisville, March 26, at 11 o'clock, for the purpose of transacting the business of the annual convention which was appointed to meet in San Francisco on the 27th.

THE Ohio Legislature has passed a law fixing \$10,000 as the maximum amount that may be recovered from a railroad company as compensation for a fatal accident.

#### Train Accidents in February.

We have made a brief record of the different accidents to trains and to locomotives which we have seen reported. Most of these were reported in the newspapers. It is not probable that our record includes all of even the more serious accidents. We hope that a study of this record may be of value in ascertaining the avoidable causes of accident:

On the 1st inst. two passenger cars of a train on the Lehigh Valley Railroad were thrown from the track by a broken rail, and one fell into the Lehigh River. Six passengers were killed and 19 injured, some of them dangerously. The weather had been very cold for some days.

On the 2d inst. a driving-wheel of a locomotive on the Marietta & Cincinnati Railroad broke while running about thirty miles an hour, between Madeira and Madisonville, near Cincinnati. No further damage was done except the throwing of one truck of the tender from the track.

On the morning of the 5th the Washington accommodation train on the Missouri Pacific Railroad was thrown from the

track two miles west of Menomonee station, and finally precipitated over a bridge over Keefer's Creek. The three passenger cars and baggage car were destroyed or very much injured, but only one passenger was dangerously injured. Twenty-one others received less serious or slight hurts. The cause of the accident is reported to have been a broken rail.

Cars of an express train on the Illinois Central Railroad were thrown from the track by a broken rail on the morning of the 8th, about a mile north of Mattoon, Ill. Cars were injured, but no person was hurt.

On the morning of the 7th a passenger train and a freight train on the Rockford, Rock Island & St. Louis Railroad ran into each other at a point three-fourths of a mile below Upper Alton. The baggage car and forward passenger car "tele-scoped," took fire, and burned. Four passengers were killed and thirteen injured—nine severely. It is reported that the freight train was ordered to wait for the passenger train to pass at the station below, but that the conductor moved it forward in direct violation of orders. A coroner's jury brought in a verdict that the deaths were caused by the criminal negligence of Frederick Baker, conductor of the freight train, as the principal, and Patrick Halpin, engineer, as accessory. These men rode to St. Louis with the conductor of the passenger train, but could not be found afterward. The freight conductor said that "he thought" the passenger train was due at Upper Alton at 6:15 instead of 6:09. There was no telegraph office between Brighton and Alton Junction, there being two stations between.

On the 9th a locomotive exploded on the new Milwaukee & Northern Railroad, killing the fireman and a brakeman. The engine was running about fifteen miles per hour at the time.

On the morning of the 9th a sleeping car and two other passenger cars of the Missouri Pacific Railroad were thrown from the track. The rail is said to have broken under the sleeping car, which rolled down the bank nearly to the river, and dragged the other cars from the track, but did not turn them over. Most of the passengers in the sleeping car were more or less bruised or cut, but not severely.

On the 12th two freight trains on the Ohio & Mississippi Railroad near Georgia Station ran into each other at full speed, destroying both locomotives and a large number of cars, but injuring no persons.

On the 12th inst., according to a telegram, a driving wheel of a locomotive "flew off" on a passenger train on the Little Miami road, causing the wrecking of the engine and the breaking of the arm of a passenger.

On the evening of the 13th locomotive No. 251 of the Erie Railway, while assisting another engine in pushing a freight train up a grade of 75 feet per mile, exploded. By the force of the explosion the engine was detached both from the caboose car in front and its tender, thrown down the bank, and completely reversed. The locomotive behind it ran into the caboose, and the latter and two oil cars and a grain car in front were set on fire and burned. Several train men and other persons were in the caboose. One track hand, riding home, was killed, and eight injured. The engineer of the exploded engine was blown out of it and badly hurt; the fireman went down the bank with the locomotive and was badly hurt. A boy riding with him was not injured.

On the 13th a passenger train on the Wisconsin Division of the Chicago & Northwestern Railway ran into the head of a freight train about two miles above Evansville, Wis. Brakes were put on and the engines reversed when they were but a short distance apart, and the shock was comparatively light. The express messenger on the passenger train was severely injured. The collision was the result of a disobedience of positive orders from the train-dispatcher to hold the passenger train at Evansville until the freight passed. The conductor "forgot."

On the afternoon of the 15th, on the Illinois Central Railroad, a wrecking train, consisting of one engine, a box car, two flats and a derrick car, was passing over a bridge across Muddy Creek, two miles above Carbondale, at the rate of about eleven miles an hour, on its way to Centralia, when the boom of the derrick, which had become unchained, swung around, and the large hook caught in the bridge, and swung part of the bridge clear of its abutments. The force of the wrench disengaged three cars, two flats and a box, which ran off the bridge into the dry bed of the creek below. Three brakemen were slightly injured and the bridge made impassable for a few hours.

A telegram reports a butting collision by two freight trains on the St. Louis & Iron Mountain Railroad, eight or ten miles south of St. Louis, on the night of the 15th, by which eleven cars and two locomotives were wrecked. The conductor of the southward-bound train, it is reported, started his train before its time. The enginemen reversed and then jumped, and so were saved. No person was injured.

On the night of the 15th a northward-bound passenger train on the Mississippi Central Railroad was thrown from the track near Viaden by a tie which had evidently been placed on the rails for that purpose. Engine, baggage and express cars were wrecked, but no one was hurt.

On the morning of the 16th a freight train ran into the rear end of another freight train which was taking on water at Clayton Station, on the Pittsburgh & Connellsville Railroad, killing the engineer and crushing four cars loaded with live stock and killing many of the animals. It is reported that the halted train had no signal displayed.

A stock express train on the Chicago, Rock Island & Pacific Railroad, on the night of the 16th, broke through a bridge near Pond Creek station, five cars of cattle falling through, and causing a few hours' delay, but no injury to persons.

On the morning of the 17th an axle of a passenger car on a train on the Morris & Essex Railroad was broken while crossing the "Meadows," and it and other cars of the train were thrown from the track. No one was injured.

On the night of the 18th, on approaching the bridge of the Savannah & Charleston Railroad over the Savannah River, the engineer of the southward-bound train found the trestle work insecure, and so uncoupled his engine and attempted to cross



with it alone. The result was it fell into the river, and the engineer and fireman were picked up a quarter of a mile below.

On the morning of the 20th a broken rail on the Utica & Binghamton line of the Delaware, Lackawanna & Western Railway, at a point two miles north of Binghamton, threw the baggage car of a passenger train across the track and the passenger car down an embankment 25 feet high. Eight passengers were somewhat severely injured, but none fatally.

On the morning of the 21st the "fast train" going west on the Parkersburg Branch of the Baltimore & Ohio Railroad ran into a mass of rocks which had fallen upon the track, throwing the locomotive and baggage car down the bank and some passenger cars from the track. The engineer was killed, the fireman severely injured, and some passengers slightly hurt.

On the morning of the 23d a bridge on the Louisville, Cincinnati & Lexington Railroad, over Ten-mile Creek, 1½ miles above Zion Station, broke down under a passenger train, and the tender and cars—one baggage, one express and two passenger—fell down into the bed of the stream, a distance of about 25 feet. The forward passenger car was crushed almost into atoms, and the other fell on one end and its seats, with the passengers, were piled together in that end. Two passengers were killed and 53 injured, some severely, and one fatally. The bridge was a Fink suspension truss of 60 feet span, resting on stone piers. The speed of the train is reported as having been less than 18 miles per hour.

From this imperfect summary it appears that there were during the month not less than twenty-one accidents to trains or locomotives, resulting in the loss of eighteen lives and the injury (in some cases quite slight) of 138 persons. Four of these accidents were caused by broken rails (for much of the time the cold was very severe), five were collisions, two boiler explosions, two caused by broken bridges, one by a broken axle and the rest by various causes.

## Chicago Railroad News.

### Entrances for New Railroads.

The ordinances which the Railroad Committee of the Common Council have reported providing the conditions and the route by which the La Salle & Chicago, the Chicago, Danville & Vincennes, and the Columbus, Chicago & Indiana Central railroads shall be permitted to enter the city, provoke considerable opposition from the owners of property along the proposed routes, as was to be expected; for although the companies will be held responsible for all the damage they may do, yet every property owner fears that the final judgment as to the damage to his property may not be such as suits him, and others fear that they may have to bring suit in order to collect any damages, and the cost of prosecuting a case against a wealthy corporation, of course, may be made very great. But these objections arise from the nature of things, and there is no general objection to the routes as being worse than others that might be chosen. It has been suggested, however, that permission for not simply one line but a series of lines north and south on Rockwell street will be likely to limit the extension of the city westward, and that they should be compelled to run two or three miles further west, beyond the proposed West Side parks, before turning southward. There is weight in this objection, but it would be a serious injury to the railroads to make so long a detour. It is further from the south or east to Madison street at Western avenue or three miles further west than to the same street at Michigan avenue or Canal street; and every mile the track runs west from the city depot is an addition of so much to the length of the road above that of a direct line. Two or three miles added to the length of a road is of course a constant tax on its operating expenses, as well as an addition to its first cost, and will be more serious near the city than elsewhere, because the traffic there is heaviest. Whenever the number of trains on any part of the line in the city becomes dangerously numerous and the growth of the city has extended to a considerable extent across the track, the remedy will be to provide viaducts above or below the tracks.

### Chicago & Northwestern.

This company has recently made a preliminary survey for a line down the west side of the Fox River from Geneva to Aurora, which, it is reported, may be extended further south to the coal mines at Morris on the line of the Rock Island road. The line surveyed is from the junction of the St. Charles Branch at Geneva, along the west side of the Geneva Branch of the Chicago, Burlington & Quincy for about a mile, and thence eastward to the river bank, which it follows through Batavia and to Aurora, passing directly through some very productive stone quarries. If such a line shall be built, the traffic between Batavia and Aurora will be cut up pretty fine, as the Burlington Company has one line on the east side of the river and one on the west side already, and on neither of these do the rails wear very fast. But the Northwestern could make a good line between Aurora and Chicago, and get a share of the Aurora traffic, and an extension to the coal mines would be of especial value to it, as it has no coal on any of its lines east of the Mississippi.

### Chicago & Alton.

There is a company organized to build and manage an elevator at Venice, on the Mississippi, just above East St. Louis, more especially for the use of this road. Mr. McMullin, the Superintendent, made a forcible exposition of the difficulty and expense to the company of delivering grain at East St. Louis under the present circumstances at a recent meeting of the St. Louis Exchange. He says that a car loaded with grain for East St. Louis is rarely returned in less than three to eight days, and in the busy season the cars are worth \$30 a day. The very morning previous the road had 75 cars in East St. Louis waiting to be unloaded, and every side track for 80 miles was full of cars loaded with

freight for St. Louis. This, however, was owing largely to the ice blockade in the Mississippi. But similar disabilities exist there at all times, which are equivalent to a constant tax to this and other companies on all the freight consigned to St. Louis, so that it is not strange that the roads prefer to carry produce to Chicago, where they can usually get back their cars the same day. The St. Louis people have been in the habit of charging that the road unduly favored Chicago, but they will find that it is ready to make money in one place as well as the other, with sublime impartiality, if they will only give it a chance.

The annual report which we reprint elsewhere will be read with interest. The condition of the property and the result of the year's operations are found to be in a very satisfactory condition.

The trustees of the first mortgage sinking-fund bonds give notice that they have designated by lot 28 bonds numbered as follows: 317, 467, 283, 152, 55, 504, 121, 103, 279, 314, 381, 65, 178, 274, 493, 341, 434, 114, 413, 124, 32, 492, 53, 154, 147, 61, 351 and 395, of \$1,000 each, for redemption. According to the terms of the mortgage interest thereon will cease May 1, 1872.

### Chicago, Burlington & Quincy.

This company, as we learn from the *Aurora City Life*, paid its employees in Aurora for the month of January \$100,764.07. Of this, \$42,392 was paid to 754 men employed in the car department; \$45,349.80 to 731 men in the locomotive department, and \$13,022.27 to 500 track-layers. The total number of names on the pay-roll for that month was 1,985. The amount paid out for December was \$96,759.18.

### SCRAP HEAP.

#### The Mobile & Montgomery Bridges.

The *Mobile Register* of the 3d ult. gives the following description of the important works now nearly completed by the Mobile & Montgomery Railroad Company to complete its entrance into Mobile:

"The first locomotive, drawing a train of five cars, Wednesday passed over the Tensas Bridge to the Mobile River and returned with safety. At the same time an engine from this end approached and saluted her sister across the river. This bridge consists of twelve spans of triangular truss with Fink's connections, except the top chord, posts and braces. Each span is one hundred and fifty feet. Besides this, there is the draw span of two hundred and sixty feet, all iron, giving two clear openings each side of the center pier of one hundred and ten feet. The draw span weighs about one hundred and twenty tons, and can be turned with ease by one man. The whole bridge is 2,060 feet long. The piers are each composed of two cylinders of cast iron, six feet in diameter, sunk fifteen or twenty feet below the bottom of the river. Inside of the cylinders are driven twelve piles close together, and bolted, and the space between the piles and cylinder filled with a concrete of sand and shells. The bridge is one of the most complete and substantial in the country, and the entire cost, including abutments and piers, is not far from \$227,000. On this side of Tensas River is a single stretch of one and three-quarter miles of trestles, reaching to the Mobile River, over which is built a bridge of the Post combination pattern on screw-pile foundations. Each pier consists of eight wrought iron columns, six inches in diameter, at the bottom of which is a screw disk four feet in diameter, screwed from fifteen to twenty feet in the bed of the river. These columns are bound together by girt frames, making a perfectly solid structure. The center pier of the drawbridge is eight inches in diameter, with a disk of six feet; the other columns, ten in number, and screwed in a circle, are of the same diameter as the other pieces. The draw is of about the same dimensions as that of the Tensas, all iron and about the same weight. With the exception of the draw, the bridge is completed, and presents a light and graceful, but, at the same time, strong appearance. The remaining five spans are one hundred and ten feet each, making the total length of bridge nine hundred and sixty feet. The cost is about \$135,000. Between the Mobile River and Mobile the road crosses a number of small streams, necessitating half a mile more trestle and five small wooden drawbridges of the Howe truss pattern."

#### Another Grand Duval Time Card.

We have received a copy of the special time card by which the train was run which carried the Grand Duke Alexis and suite from St. Louis to Louisville, over the Vandalia Line and the Jeffersonville, Madison & Indianapolis Railroad, on the 29th ult. In general appearance it is very like the St. Louis, Kansas City & Northern time card we noticed a short time ago, being in wedding invitation style, with monogram of the Vandalia Line on the envelope, and the Russian double-headed eagle on both card and envelope. Above the time-table, however, is a "birds-eye view" of the country over which the line passes, in which the Mississippi, the Ohio, the Wabash and the White loom up as the chief features of the landscape, barring the railroad; the cities cover most of the ground, and the heads of the two smaller streams rear high in air against the sky in a threatening, serpentine manner.

By the card we learn that the train left St. Louis at 10 p.m. and reached Louisville at 2:45 p.m., thus making the trip of 348 miles in 16½ hours—a little less than 21 miles an hour—which is certainly a good, safe, comfortable rate for people who want to sleep, as Alexis & Co. probably did.

#### San Francisco and Australia Steamers.

The Australian and New Zealand steamship subsidy bill, granting half a million dollars annually to the Webb line of steamers for thirteen round trips annually, has received the approval of the House Committee on Commerce, only two members—Messrs. Holman and Townsend—dissenting. The last outward steamer of the line—the Nevada—arrived at Sidney in exactly two hours after the British steamer from Point de Galle, each bringing London mails of the same day.

## General Railroad News.

### ELECTIONS AND APPOINTMENTS.

—John B. Morford has been appointed Superintendent of the Long Island Railroad, to succeed J. D. Barton, who has accepted the superintendency of the United States Rolling Stock Company.

—Charles H. Richmond, of Ann Arbor, Mich., has been appointed Treasurer of the Detroit, Hillsdale & Indiana and the Detroit, Eel River & Illinois railroads, with headquarters in Detroit.

—Joseph F. Humphrey has been appointed General Accountant of the Denver Pacific Railroad in place of Maj. William Wagner, resigned.

—Maj. William Wagner has been appointed Auditor of the Denver & Rio Grande Railway Company.

—Mr. R. B. C. Bement has been appointed Chief Engineer of the Chicago, Dubuque & Minnesota Railroad, in place of Captain J. F. Ainsworth, resigned.

—J. C. Lopez has been appointed Assistant Superintendent of the New Orleans, Mobile & Texas Railroad.

—At a meeting of the Liberty & Vienna Railroad Company, on the 20th of February, Messrs. Thomas Struthers, John Stambaugh, George Tod, Evan Morris and Jacob Stambaugh, directors, resigned their positions, and the vacancies were filled by Messrs. J. M. Ferris and H. F. Sweetzer, of the Atlantic & Great Western Railroad, and Daniel J. Day, S. L. M. Barlow and Charles Day, of New York city. John Tod, President, resigned, and J. M. Ferris was elected in his place. Jacob Stambaugh, Secretary, resigned, and Daniel J. Day was elected in his place. These changes were made in consequence of the sale, by the original members of the company, of their stock to the Atlantic & Great Western Railroad Company, or to parties representing that company.

—James A. Hill, for seven years past General Freight Agent of the Ohio & Mississippi Railroad, has resigned, and William Duncan, long in the service of the company, and for two years past its contracting agent in the St. Louis Exchange, has been appointed to succeed him.

—The following directors have been chosen by the Cincinnati & Springfield Short Line Railroad Company: R. M. Shoemaker, J. N. Kinney, Seth Evans, Horace F. Clark, H. B. Hurlbut, Oscar Townsend, Selah Chamberlain, Rush R. Sloane, J. H. Devereux.

—Edward Lowell and R. H. Hardaway were among the recently elected directors of the Atlantic & Gulf Railroad Company of Georgia, instead of E. C. Anderson and Octavius Cohen, as heretofore reported.

—At the annual meeting of the Springfield & Illinois Southeastern Railroad Company, held in Springfield, Ill., on the 28th ult., the following officers were chosen: President, Thomas S. Ridgeway, Shawneetown, Ill.; Vice-President, Charles A. Beecher, Fairfield, Ill.; Treasurer, J. M. Bloodgood, New York; Secretary, George N. Black, Springfield.

—G. W. Washburne has resigned his position as Vice-President of the Oshkosh & Mississippi Railroad Company.

—The following appointments have been made on the Connecticut Western Railroad: S. Greer, Road Master; Wylie A. Yeomans, Master of Transportation, and N. Shugland, Master Mechanic.

—At the annual meeting of the Marietta & Cincinnati Railroad Company, February 21, the following officers and directors were elected: John King, Jr., President; Wm. H. Oldham, Treasurer; C. F. Low, Secretary and Auditor; W. Jones, Cashier and Register. Directors: John King, Jr., John Hopkins, Thomas Whitridge, A. A. Chapman, J. Donnell Smith, Baltimore; Nathaniel Wright, R. M. Bishop, W. W. Scarborough, J. D. Lehmer, Cincinnati; W. T. McClintock, John Madeira, Chillicothe, O.; Wylie H. Oldham, Marietta, and John Camden, Parkersburg, W. Va. All these were re-elected.

—At the annual meeting of the Maine Central Railroad Company in Waterville, Me., on the 28th ult., the directors were all re-elected. They are: R. D. Rice, of Augusta; A. P. Morrill, of Readfield; A. Coburn, of Skowhegan; J. B. Brown, of Portland; R. B. Dunn, of Waterville; D. Allen, of Augusta; A. D. Lockwood, of Lewiston; H. N. Jose, of Portland; Geo. L. Ward, of Boston, and Geo. M. Patten, of Bath. One vacancy was left, as usual, for the city of Bangor to fill. The board reorganized by the election of its old officers—the Hon. R. D. Rice, President; the Hon. Anson P. Morrill, Vice-President, and the Hon. Josiah H. Drummond, Clerk.

—William Keavy, formerly General Ticket and Freight Agent of the Alabama & Chattanooga Railroad, and before in the service of the Michigan Central, has been appointed General Freight Agent of the Fort Wayne, Jackson & Saginaw Railroad, with office at Jackson, Mich.

—C. J. Marsh has been appointed General Agent of the Cincinnati & Indianapolis Junction Railroad, in charge of passenger and freight business.

—Henry Steffee has resigned his position as General Ticket Agent of the Louisville, Cincinnati & Lexington Railroad, and S. S. Parker will hereafter act as General Passenger and Ticket Agent.

—At the annual meeting of the stockholders of the Union Pacific Railroad Company in Boston, on the 6th inst., the following directors were elected:

Horace F. Clark, Augustus Schell, James H. Banker, Oliver Ames, John Duff, Elisha Atkins, Oakes Ames, L. P. Morton, R. E. Robbins, James Brooks, G. M. Dodge, Sidney Dillon, C. S. Bushnell, George M. Pullman and Gordon Dexter.

Messrs. Clark, Schell, Banker and Dexter are the new men on the board, in the place of Messrs. Scott, Thomson, Carnegie and Dennison.

At a subsequent meeting of the Board of Directors the following officers were elected: President, Horace F. Clark, of New York; Vice-President, John Duff, of



Boston; Treasurer, E. H. Rollins, of Concord, N. H.; Auditor, H. B. Wilbur.

—At a meeting of the Belleville & Eldorado Railroad Company in Benton, Ill., on the 3d ult., the following directors were chosen: F. M. Youngblood, Z. Hickman, Wm. Dudley and Richard Richeson, of Franklin County, and Wm. Elder, Geo. E. Bennett and Henry Weber, of Saline County, Ill.

The directors elected the following officers: President, Jos. J. Castle; Vice-President, F. M. Youngblood; Treasurer, B. Temple.

—The Springfield & Illinois Southeastern Railroad Company at its annual election on the 28th ult. chose the following directors:

W. T. Cutler, Marietta, Ohio; E. C. Dawes, Cincinnati, Ohio; F. W. Tracy, A. Starne, George N. Black, O. Smith, Springfield, Ill.; T. S. Ridgeway, Charles Carroll, Shawneetown, Ill.; W. B. Wilson, Flora, Ill.; C. A. Beecher, Fairfield, Ill.; J. D. Slayback, Henry Prince, M. H. Bloodgood, New York. In this board J. D. Slayback and Henry Prince succeed John W. Priest and C. W. Mathews, of Springfield.

#### PERSONAL.

—Sidney Dillon, whose railroad contracts now frequently count into the millions, and who did a very large portion of the work on the Union Pacific, began the business as foreman for a contractor for a short section of the Boston & Providence road, and his first contract was for a short section of the Western Railroad, now the western part of the Boston & Albany.

—Daniel Nason, formerly Superintendent of the Boston & Providence Railroad, died in Boston on the 4th inst.

—Andrew J. Jones, late President of the Western Railroad Company of Delaware, charged with fraudulent use of the bonds of the company, and tried before the Superior Court of Moore County, Del., last week, was convicted and sentenced to pay a fine of \$10,000 with one year imprisonment in the Penitentiary. He takes an appeal to the Supreme Court.

—Hon. George L. Becker has resigned the Presidency of the St. Paul & Pacific Railroad Company, a position which he has held for eight years, from its beginning.

#### TRAFFIC AND EARNINGS.

—The earnings of the St. Louis, Kansas City & Northern Railway (late North Missouri) for the month of January were: 1872, \$230,380; 1871, \$191,789; increase, \$47,591, or 25 per cent., and for the month of February, 1872, \$245,000; 1871, \$192,120; increase, \$52,880, or 27½ per cent.

—The following official report has been made of the tonnage passing through the Suez Canal during the year 1871:

British.....	546,621	Belgian.....	4,400
French.....	91,841	American.....	4,170
Austrian.....	43,113	German.....	3,580
Italian.....	29,400	Spanish.....	3,157
Turkish.....	16,959	Norwegian.....	1,316
Egyptian.....	13,394	Portuguese.....	919
Dutch.....	6,711	Danish.....	660
Russian.....	4,820	Burmese.....	408
Total.....	771,409		

England seems ready enough to use the canal, though she was suspected of not favoring its construction.

—The receipts of the Grand Trunk Railway of Canada for the week ending Feb. 10 were: 1872, \$32,800; 1871, \$20,100; increase, \$12,700, or 12½ per cent.

—The receipts of the Great Western Railway of Canada for the week ending Feb. 9 were: 1872, \$16,674; 1871, \$18,785; decrease, \$2,121, or 11½ per cent.

—The earnings of the St. Louis & Iron Mountain Railroad for the third week of February were: 1872, \$40,476; 1871, \$27,617; increase, \$12,859, or 49½ per cent.

—The receipts of the Toledo, Peoria & Warsaw Railway for the month of January were: 1872, \$108,188.01; 1871, \$79,698.03; increase, \$28,489.98, or 35½ per cent. For February the receipts of the same road were: 1872, \$100,438.70; 1871, \$71,743.32; increase, \$28,695.38, or 40 per cent.

—The receipts of the Milwaukee & St. Paul Railway for the month of February were: 1872, \$387,525; 1871, \$327,431; increase, \$60,094, or 18½ per cent. The increase in January was \$64,256, or 16½ per cent.

—The earnings of the Pacific Railroad of Missouri for the third week in February, 1872, were \$56,202; third week in February, 1871, \$53,823; increase, \$2,379, or 4½ per cent.; for year commencing March 1, 1871, \$3,552,600; for year commencing March 1, 1870, \$3,429,387; increase, \$123,213, or 3½ per cent.

—The earnings of the St. Louis & Iron Mountain Railroad for the third week in February were: 1872, \$40,476; 1871, \$27,617.36; increase, 1872, \$12,858.64, or 46½ per cent.

—The earnings of the Marietta & Cincinnati Railroad for the fourth week of February were:

	1872.	1871.	Increase.
Passenger.....	\$2,378	\$7,472	\$906
Freight.....	31,222	22,741	8,481
Mail, express and telegraph.....	2,010	1,100	910
Total.....	\$41,610	\$31,313	\$10,297

This is an increase of 33 per cent., and the increase in freight receipts is more than 37 per cent. The receipts for the month of February were: 1872, \$142,408; 1871, \$126,224; increase, \$16,184, or 12½ per cent. And for the two months since the close of the year: 1872, \$294,985; 1871, \$257,107; increase, \$37,878, or 14½ per cent.

—The Hannibal & St. Joseph Railroad Company reports its earnings for the year 1871 at \$2,902,803.24, as against \$3,425,999.80 in 1870, showing a decrease of \$523,196.56, or more than 15 per cent., a truly formidable decrease in these prosperous days. The decrease

is attributed to increased competition, but the chief new competing lines—the Chicago & Southwestern and the Chicago & Alton—did not enter the field until September or October, and the decrease was quite as great before as after that time.

—The receipts of the Hannibal & St. Joseph Railroad for January were: 1872, \$150,496; 1871, \$169,396; decrease, \$18,900, or 11 per cent. These receipts are the lowest for thirteen months, nearly \$92,000 less than the average of 1871, and \$135,000 less than the average of 1870. January was in some respects a trying month to Western roads, but in that month the traffic of the rivals of the Hannibal & St. Joseph was much more affected than its own.

—The receipts of the Chicago & Alton Railroad for the month of February were: 1872, \$329,170.40; 1871, \$342,368.54; decrease, \$13,198.14, or 3½ per cent. The closing of the Mississippi, which prevented transfers of freight and frequently of passengers throughout most of the month, both at St. Louis and at Louisiana, had a very serious effect on business at that end of the line, and the lack of elevator room at Chicago greatly limited grain shipments to that place.

#### OLD AND NEW ROADS.

##### Memphis & Charleston.

This company owned the McMinnville & Manchester Railroad of Tennessee, which is really a branch of the Nashville & Chattanooga (having no other railroad connection), and had entered into obligations to extend it and also what was known as the Southwestern Branch. These branches the Southern Security Company would not include in the lease, and the stockholders have authorized the directors to dispose of them as they may deem to be best for the company. Tanner, Walker, McAnery & Co., of New York, have made proposition to lease the lines and complete them on certain conditions.

Although so much interest was manifested in the lease to the Southern Security Company, only 131,116 of 212,000 shares were represented at the meeting, and though only 9,560 shares were voted against it, the majority of the entire stock in its favor was only 16,556, a little more than three-fifths voting for the lease. It is probable, however, that most of the stock not voted was in favor of the lease, as the opposition was very active.

##### St. Croix & Lake Superior.

A bill giving an extension of time to the State of Wisconsin for the completion of this railroad, by which it will secure a land grant, was debated in the House on the 29th ult., and, contrary to previous expectation, it was not carried. A motion to lay upon the table at one time lacked but one vote of a majority; but finally the bill was referred to the Committee on Public Lands, which, it is thought, will prevent its passage this session.

##### Denver Pacific.

Right on the heels of an announcement that the Union Pacific had made arrangements with this company by which the two lines would be worked together for Colorado, comes a formal statement that the stockholders of the Denver Pacific have transferred their stock to the Kansas Pacific.

##### Harlem River & Port Chester.

Contracts have been awarded for the construction of this railroad, which is to be completed by the close of the year.

##### Texas Pacific.

The Senate Committee on Pacific Railroads has agreed to report favorably a bill introduced by Senator Scott giving this company the right of way (but no subsidy) for a branch from Fulton, Ark., to the main line between Marshall and Dallas, Texas. This may indicate that the company wishes to make a northeastern outlet by the way of Little Rock.

##### Missouri, Kansas & Texas.

A branch of this railroad is proposed from a point on the Sedalia Division a little southwest through Butler, Mo., Pleasanton and Mound City, Kan., to Neosho Falls, on the Neosho Division of the same road. The line is to be constructed under the "St. Louis & New Mexico" charter, and towns have begun to vote aid to it.

##### Waco Tap.

This branch of the Houston and Texas Central is completed from Bremond northwest to Marlin, 18 miles.

##### Milwaukee & St. Paul.

The contract for constructing the part of this company's new road between Milwaukee and Chicago from Chicago to Racine has been let to R. B. Langdon & Co., of Minneapolis, Minn., who have also taken the contract for constructing this company's line from Winona, Minn., down the Mississippi 27 miles to La Crosse, opposite La Crosse. The work on the Chicago line is to be completed by October, the other by the middle of August.

##### Panama Railroad.

This company has five steamers on the Pacific coast which touch at the chief ports of the Central American States, and are now to extend their trips to the lower Mexican States, a Government mail contract and subsidy having been granted for that purpose.

##### Sioux City Railroads.

The Sioux City Times enumerates the various railroads in progress about that town. These are the Dakota Southern, from Sioux City northwest to Yankton, 65 miles, to complete which by the middle of October a great effort will be made; the Sioux City & St. Paul, all under contract to be completed by July; the Sioux City & Pembina, which is to use 20 miles of the Dakota Southern road from Sioux City northward, and to be graded 55 miles further, to Sioux Falls, during the year; and the Northern Nebraska, which has had considerable municipal subscriptions to aid it in carrying out its project for a road from Covington (opposite Sioux City) west by north on the south side of the Missouri to Niobrara, about 90 miles.

##### Houston & Great Northern.

It is proposed to extend the Huntsville Branch of this road northwestward to Belton, 120 miles, crossing the Houston & Texas Central and the International at Hearne, 65 miles from Huntsville. Such a line would connect the plains and prairies of northwestern Texas with the great pine forests between Houston and Huntsville.

##### Lexington & St. Louis.

This railroad is again announced as completed.

##### Kansas Central.

This narrow-gauge railroad has recently received and tried some passenger rolling stock which is reported to give entire satisfaction.

##### Atlantic, Mississippi & Ohio.

This company has recently received ten very fine passenger, baggage and mail cars, built by the New Haven Car Company, supplied with Miller platforms and Grant's safety stoves (which are so constructed that in case they are turned over or on one side the fire will be put out by a tank of water provided for that purpose), and are altogether very handsome and comfortable.

##### Fredericksburg, Orange & Charlottesville.

This company perfected its organization at a meeting in Fredericksburg, Va., on the 22d ult., when T. W. Walker, of New York, was chosen President; W. M. Smith, of Philadelphia, Secretary, and directors who are chiefly residents of Pottsville, Pa., and of New York.

##### Kansas City, Independence & Lexington.

Under this name a company has been chartered in Missouri to construct a narrow-gauge railroad from Kansas City along or near the south bank of the Missouri to Lexington. One of the chief objects is the transportation of coal from Lexington. The officers are: William Chrisman, President; Preston Roberts, Vice President; J. Q. Watkins, Treasurer; A. S. Packard, Secretary.

##### Marshall & Coldwater.

An agent of the Pennsylvania Company has been examining this line and its resources, with a view, it is understood, of fixing its value as a branch of the Mansfield, Coldwater & Lake Michigan Railroad, which it has a contract to lease as soon as completed. It is expected that the Marshall & Coldwater road will be completed under the auspices of the Pennsylvania Company and extended as far north at least as the Flint & Pere Marquette Railroad.

##### Lafayette, Bloomington & Mississippi.

On the 21st ult. the track of this road was laid from Bloomington as far east as a point 10 miles west of the Indiana line, and within 3½ miles of Hoopeston, on the Chicago, Danville & Vincennes road. The gap will soon be closed, and then, when the line has been put into order, the Toledo, Wabash & Western will be able to send cars through from Toledo to Bloomington.

##### Central Pacific.

On the 29th ult. the House Pacific Railroad Committee reported a bill which provided that this company may occupy Goat Island in San Francisco harbor for a terminal station and docks.

##### Northern Pacific.

Regular trains, passenger and freight, are reported to be running as far west as Oak Lake, 200 miles from Duluth.

##### Milwaukee & Nashua.

The first shipment of iron for this road has been received at Nashua, Iowa.

##### The New York City Railroad Projects.

It is reported that the different parties asking for a charter for an underground railroad in New York have combined and will unite in asking for an amendment to the charter of the company known as the "Central Underground" which will authorize a road under Broadway. One of the chief obstacles to the carrying out of any scheme has been the great number offered, and the different parties asking for authority.

##### San Joaquin Valley.

The San Francisco Bulletin says of this branch of the Central Pacific:

"This road is completed to Merced, a point nearly seventy miles southerly from Stockton, and is being extended at the rate of a mile a day. It will reach Visalia early enough the current year to move the harvest of the Tulare Valley, and near that point will eventually connect with the Southern Pacific, whether the latter road crosses from Hollister or from the lower end of the Salinas Valley. The San Joaquin and Tulare valleys offer independent local inducements for a railway, sufficient at the present time to warrant the completion of the one under way, as its builders well know. From the point of intersection of this road with the Southern Pacific, the latter will be constructed as one road, to meet the Texas Pacific in San Diego County, and parties of surveyors are now in the field looking out a route for this part of the road."

##### Grand Rapids & Indiana.

Hon. Joseph K. Edgerton, one of the directors of this company, has addressed a communication to the Common Council of the city of Fort Wayne, which city owns about \$100,000 of the stock of the company, calling attention to the company's proposed issue of \$1,200,000 8 per cent. bonds, "professedly for the purpose of procuring additional equipments for the road, in view of its prospective increase of business from the Cincinnati, Richmond & Fort Wayne Railroad, and a branch road in Michigan from near the Manistee River to Traverse City—this latter road having been lately taken under the auspices of the Continental Improvement Company." Mr. Edgerton says that by the contract made with the Continental Improvement Company, that company engaged to construct and equip the road, and, until that time, is entitled to operate it and receive the income, and as an additional compensation for construction it is also to become the owner of the railroad company's land grant and of a majority of its capital stock, the land grant



alone being estimated to become worth from \$10,000,000 to \$12,000,000. He urges that there is no warrant for any issue of bonds for equipment, and that the addition of them to the obligations of the company will, in his opinion, leave no hope of a dividend or value to the capital stock. He claims also that the lease of the Cincinnati, Richmond & Fort Wayne road was made without legal authority, and is an injury to the stockholders.

#### Shenandoah Valley.

The Central Improvement Company at Front Royal, Virginia, have made their allotments of work on the Shenandoah Valley Railroad, the contracts being awarded as follows:

Sections 1, 2, 3, 4, 5 and 6—John M. Barry & Co., Lancaster, Pa.  
Sections 7 and 8—Henry Ettle, Middletown, Pa.  
Sections 16, 17, 18, 19, 20, 21, 22, 23, 24 and 25—H. H. Crumlish, Wilmington, Del.  
Sections 26, 27, 28, 29 and 30—Donahue & Bros., Emmetsburg, Md.  
Sections 31 and 32—Purcell & Co., White Post, Va.  
Sections 33, 34, 35, 36 and 37—Meehan & Borland, Richmond, Va.  
Sections 38, 39, 40, 41 and 42—Malone & Gillese, Lancaster, Pa.

#### "Palmer Elevated Railway."

A bill has been introduced in the New York Assembly to incorporate the Palmer Elevated Railway Company. It names James H. Howe, William Southerland, Charles Straightthoff, Roswell Reed, William Palmer, Charles Hood, William Walton and S. T. Streeter as the incorporators, and fixes the capital stock at \$3,000,000, with power to increase the same from time to time to \$10,000,000 if more than one road be built. It applies the provisions of the general railroad act to the company. One road is to start from the junction of Hudson street with Chambers street and West Broadway, New York, and run along Hudson street to Ninth avenue and thence to the Harlem River. The other road starts at or near Chatham square, runs through the Bowery to Third avenue and thence to the Harlem River. The roads may have two or four tracks. The construction of the roads shall be commenced within four months, and completed within one year and six months. Fifteen cents may be charged for transporting passengers the full length of the road, and ten cents for intermediate distances. Five per cent. of the net income of said railways shall be annually paid into the treasury of the city of New York.

#### Richmond, Fredericksburg & Potomac.

The extension of this railroad to Quantico is to be opened this month.

#### Lynchburg & Danville.

Additional force has been put at work on this line, and its completion is now set for the 1st of September.

#### Washington & Ohio.

A considerable force is engaged on the extension of this road beyond Hamilton.

#### Houston & Lagrange.

There is talk of constructing a narrow-gauge railroad from Houston, Texas, a little north of west to the Colorado River at Lagrange, a distance of about 90 miles. Such a line would be about half-way between the two lines of the Houston & Texas Central.

#### Holyoke & Belchertown.

Engineers are surveying a route for a railroad from the New London Northern Railroad at Belchertown, Mass., southeast about 12 miles to Holyoke.

#### Housatonic Railroad.

The receipts of this railroad for 1871 were \$780,280, against \$752,097 in 1870, and \$502,604 in 1866. The expenses were \$604,120, and dividends amounting to \$142,810 were paid, leaving, with a former surplus, \$65,597 in the treasury. Three locomotives, costing \$31,418 (one built by the company); two passenger and 40 freight cars, costing \$45,000, have been added; five new depots have been built and two enlarged; 1,428 tons of rails laid, and 1,500 tons are under contract to be placed during 1872. Fifty thousand dollars of 6 per cent. bonds were issued, to be expended in permanent improvements. The rolling-stock of the road now consists of 16 engines, 24 passenger and 330 freight cars (25 of the latter Red Line).

#### Brunswick & Albany.

Col. John D. Rumph, Master in Chancery, appointed to investigate and report upon the financial affairs of the above road, makes the following exhibit:

"Number of claims filed, 494; aggregate amount of claims filed, \$3,383,235.18; amount of claims adjudged satisfactorily established, \$423,369.28; amount of lien and other claims in execution, with costs, as charged, included, \$107,278.10; amount of lien and other claims in execution adjudged satisfactorily established, with legal costs established, \$98,381.34; amount of labor liens, other than liens, judgments, etc., adjudged legally and justly due, \$13,141.39; amount of lien and other claims in execution, with costs, as charged, and other labor claims as presented, \$122,849.47; amount of approved lien and other claims in execution, with estimated legal cost, with other labor claims, approved, \$111,522.73."

The *Augusta Chronicle and Sentinel* says: "This road received from the State eight thousand straight gold bonds per mile, besides the State indorsement of fifteen thousand dollars gold for each mile. The gross amount received from the State for the construction of the road is over four millions of gold, yet we find the company in debt \$3,383,235. Truly, H. I. Kimball was a great developer of Georgia's resources."

#### Western Indiana.

This new company filed articles of association on the 29th ult. Its proposed line extends from Brazil, Clay County, Ind., through Parke and Fountain counties to a point on the Illinois State line, about ten miles southeast of Rossville, Ill., a distance of about 70 miles. Covington, Fountain County, and Montezuma, in Parke County, are objective points of the survey. The directors are

Edward Walker, J. S. Campbell, C. B. Mansfield, C. Greenwood and Joseph E. Young, and the names indicate that the Chicago, Danville & Vincennes (of which the road would form a branch) and the Pennsylvania Company are interested in the project.

#### Atlantic & Gulf.

At the recent annual meeting of this company, a resolution was adopted in favor of extending the road, from its present western terminus at Bainbridge westward to the Chattahoochee River.

#### Peoria, Pekin & Jacksonville.

A report is current that this road is likely to be leased to the Indianapolis, Bloomington & Western Company, which has long used the few miles of the road between Pekin and Peoria. The Pekin road would form a south-west branch to the Indianapolis road, and would perhaps be as valuable to it as to any other east and west line.

#### Atlantic, Mississippi & Ohio.

The Staunton (Va.) *Spectator* says: "It is rumored—with what truth we cannot say—that Gen. Mahone, finding himself flanked by Mr. Scott, has entered into some friendly arrangement with that gentleman, by which Mr. Scott has acquired a commanding interest in the operations of the Lynchburg & Tennessee road. If such be the fact, we think it more than probable that before long the Shenandoah Valley Railroad, which is said to be under contract from the Potomac to Front Royal, will be extended up the Valley to Salem, thereby giving the Pennsylvania Central Railroad an unbroken line of railway from Philadelphia to Memphis, and leaving Baltimore out in the cold."

But the "Mr. Scott" having already a complete line from Baltimore to Richmond, will need no new road to complete a connection with the Atlantic, Mississippi & Ohio, and the Shenandoah Valley line, if built, will be made for its own traffic, probably, rather than for that of its connections.

#### Cairo & Vincennes.

By a telegram from Indianapolis we learn that a deed of consolidation between the Vincennes & Cairo Railroad Company, in the State of Indiana, and the Cairo & Vincennes Railroad Company, in the State of Illinois, extending the latter road from the line of Indiana to the terminus of the Indianapolis & Vincennes Railroad at Vincennes, was filed with the Secretary of State of Indiana on the 29th ult. The name of the new road is to be the Cairo & Vincennes Railroad, with a capital stock of \$4,000,000. The consolidation is a virtual sale of the Vincennes & Cairo road to the Cairo & Vincennes, the road to be completed by the latter company.

#### Cincinnati & Terre Haute.

Certificates of incorporation of this company were filed with the Secretary of State of Ohio on the 28th ult. The termini of the road (in Ohio) will be the city of Cincinnati and the point of intersection of the western boundary of the State of Ohio in Hamilton County and the line of the Cincinnati & Terre Haute Railway Company of Indiana. The road is wholly in the County of Hamilton. The capital required to construct the road is one million dollars. The incorporators are Larz Anderson, Richard M. Bishop, Joseph C. Butler, George H. Hill, Thomas G. Gaylord, Luke S. Brien and George H. Pendleton.

#### Kentucky & Great Eastern.

The Cincinnati *Railroad Record* learns from Mr. A. J. Hadder, Vice-President of this company (and also one of the editors of the *Railroad Record*) that 146 miles of this line, from Newport to Catlettsburg, Ky. (completing the connection between the Chesapeake & Ohio Railroad and Cincinnati), has been put under contract to Alton & Beach, of New York.

#### Cedar Rapids & St. Louis.

It is reported that this company's bonds have been negotiated, and that it will have the iron down on its line from Ottumwa to Sigourney, 25 miles, early this spring.

#### Missouri, Iowa & Nebraska.

We are informed that this company will fix its line from Lancaster, Mo., nearly due northwest to Centerville, Iowa, about 30 miles, and thence nearly due west through county seats of the southern tier of counties of Iowa to Nebraska City.

#### Louisville, New Albany & St. Louis Air Line.

From the annual report of the President, Mr. Augustus Bradley, of New Albany, Ind., we take the following paragraphs:

"Messrs. Chamberlain, Matthews & Co., our contractors, are progressing with the work in a very satisfactory manner, and, unless something unusual should occur, unforeseen at this time, they will be able to complete our road within the contract-time, which is the 1st day of January, 1873."

"The company has recently effected a very liberal arrangement with the Jeffersonville, Madison & Indianapolis Railroad Company for the use of their track from New Albany hence to the Ohio River bridge—including the crossing of the bridge—for the transportation of the business of our road between the city of Louisville and the city of New Albany, and also a similar arrangement for the business of our road between the cities of New Albany and Jeffersonville."

"The completed portion of our road between Princeton and Mt. Carmel—a distance of about ten miles—which has been in operation about thirteen months, I am pleased to say has been more than self-sustaining. It has not only paid the operating expenses of the same, but has paid a few hundred dollars into the treasury of our company besides."

"During the past year work on our road has steadily progressed. Fortunately we have always been ready to meet the demands against us as the same became due, and, so far as I can see at this time, everything connected with its building has a very encouraging aspect. Stockholders are meeting the calls made upon them very promptly. The contractors are pushing the work with a good deal of energy, and there seems to be no good rea-

son why the road should not be ready to operate on behalf of the company by the first day of January, 1873, its entire length."

"The building of the Illinois connection is also progressing very well, under the auspices of President Robert Bell. From Mt. Carmel to Albion, a distance of 17½ miles, the laying of the rails has just been completed. This leaves a gap to finish of about 47 miles to Mt. Vernon, Ill., where it connects with the finished portion of the St. Louis & Southeastern road to St. Louis, distance 76 miles. This gap can easily be finished during the year 1873, which, upon the completion of our line of road, gives an unbroken line from Louisville, Ky., to St. Louis, Mo."

#### Toledo, Thorntown & St. Louis Air Line.

A telegram from Indianapolis says that articles of association of the Crawfordsville & Illinois Railroad Company were filed with the Secretary of State of Indiana on the 28th inst. Capital stock, \$50,000. The articles of consolidation of the Toledo, Thorntown & St. Louis Railroad Company of Indiana and the Toledo & St. Louis Air Line Railroad Company of Ohio, were also filed. The two companies were then consolidated with the Crawfordsville & Illinois Railroad Company, and the name of the organization will hereafter be the Toledo, Thorntown & St. Louis Air Line Railroad Company.

#### Elizabethtown & Paducah.

On this railroad henceforth work will progress at both ends. At the Paducah end the first rail was laid on the 27th ult. There remain 63 miles to be completed.

#### Madisonville & Bowling Green.

The people along the line are organizing a company to construct a railroad from Madisonville, Ky. (on the Evansville & Nashville line 50 miles south of Evansville), southeast about 70 miles to Bowling Green, on the Louisville & Nashville Railroad. It could be worked in connection with either the Evansville & Nashville, the Elizabethtown & Paducah, or the Louisville & Nashville.

#### Virginia & Truckee.

The extension of this Nevada railroad from Reno to Virginia is to be completed by July.

#### Mobile & Ohio.

This company has discharged its indebtedness to the State of Tennessee by paying into the treasury \$1,700,000 in bonds and coupons.

#### Upper Mississippi Steamers.

The Winona *Republican* learns from Captain Jo Reynolds, General Manager of the Diamond Jo line, that the steamer Arkansas will take her place on the Upper Mississippi at the opening of navigation, and he also intends to purchase another steamer in a few weeks, to make, with the Diamond Jo and the Ida Fulton, a line of four boats between Fulton and St. Paul. They will make regular trips, so as to give one boat of the line every day between the various points on the river.

#### St. Louis Bridge.

Concerning the progress of the work for the superstructure of this great work the St. Louis *Republican* says: "The Butcher Steel Works now turn out forty steel staves a day, and also innumerable steel pins, nuts, tension-rods, &c. The average weight of the staves is about a hundred pounds each; they are twelve feet in length, about two inches in thickness, and six thousand will be required altogether. Upward of one thousand are now finished and ready to be put together into tubes. Each tube will consist of six staves. The shape of the latter is the segment of a circle, and they will be put into the tubes like the staves of a barrel, except that instead of hoops, sheets of steel will be placed round them. There have been about twenty tubes put together in the yards of the Keystone Bridge Company, and the men have become so expert that they can prepare a tube in forty-five minutes. In addition to the steel work, the wrought iron beams, brace-bars, &c., are being turned out in large quantities, and iron bridges over Main street and Second street will be completed before long."

"The masonry has been much delayed by the unusually severe winter, but is being pushed with the utmost vigor since the thaw set in. All the granite is on hand, and the company expects to have the masonry all completed within three months."

#### North Missouri.

William Hoge, of New York, filed a declaration in the United States Court at St. Louis, on the 28th ult., against the North Missouri Railroad Company, setting forth that, in October and January last, he obtained two judgments against the said road amounting to \$353,000; that execution was issued and returned, indorsed that no property could be found which could be levied on and sold under execution. He further declares that the Rogers Locomotive and Machine Company of New Jersey, George Howard and James Low of New York, George D. Humphrey, E. H. Fox and the Boatmen's Savings Institution of St. Louis, obtained judgments against the same road in October and January aggregating \$1,000,488, which are unpaid. The complainant prays for a decree ordering the sale of the road and all its property at auction in St. Louis; and that the proceeds of the sale be distributed by the Court among the judgment creditors, in accordance with their legal rights; and the residue, if any, be held for further orders by the Court.

#### Baltimore & Ohio.

"Gath," of the Chicago *Tribune*, writes from Washington:

"The Baltimore & Ohio Railroad expects to open in June a direct line hence to Point of Rocks, reducing the time to Pittsburgh and Cincinnati two or three hours, and avoiding all changes and transfers. This piece of road, though only 42 miles long, was estimated to cost \$2,000,000; and one single mile upon it, near the mouth of the Monocacy River, has already cost nearly \$300,000. The country between Washington and Harper's Ferry consists of a series of bold, almost mountainous, hills, which are crossed transversely by streams emptying into



the Potomac; and this road is to leap every stream on a high and costly bridge, and then plunge immediately into a heavy rock-tunnel. In one place, 100,000 cubic yards of rock and earth had to be moved. Some of the cuts are 50 feet deep, and many of the embankments 60 feet high. The cuts are only 18 feet wide at the bottom, and only ten men can work in each end of the cut—in some cases progressing no more than 25 feet in one month."

#### Southern Security Company.

The Richmond *Whig* gives the subjoined list of railroads in which this company holds a majority of stock, or which it has leased:

Railroads.	Miles.	Shares.
Wilmington & Weldon.....	181	8,391
Northeastern of South Carolina.....	102	8,965
Richmond & Danville.....	190	24,000
East Tennessee, Virginia & Georgia.....	270	8,470
Charlotte, Columbia & Augusta.....	105	13,024
Richmond & Petersburg.....	22	6,871
Cheraw & Darlington.....	40	4,513
Wilmington, Columbia & Augusta.....	195	13,024
Aggregate.....	1,187	

#### Alabama South & North.

The Nashville *Banner* says: "Three thousand laborers are now engaged in the construction of the South and North Railroad, and the contractors hope to finish it by July. Ten car-loads of iron have been shipped from Chattanooga to Decatur for that road daily, during the past week. The building of the first bridge beyond Decatur will be commenced this week, the necessary materials being ready for framing. The road will doubtless go into operation by the 1st of September."

#### Springfield & Illinois Southeastern.

At the annual meeting on the 28th ult., a proposition was submitted by parties from Schuyler and McDonough counties, for the extension of the road from Beardstown northwest to Burlington, on the Mississippi River, which was favorably received. The rails for the extension from Altamont to Pana, filling the gap in the line, are arriving and will soon be laid.

#### Bellefonte & Eldorado.

The Shawneetown *Mercury* reports that Winslow & Wilson have taken a contract for the construction of this railroad in Southern Illinois, beginning at Eldorado, on the St. Louis & Southeastern Railway 19 miles from Shawneetown, and extending thence westward.

#### Raritan Bridge.

The injunction restraining the construction of a railroad bridge across the Raritan has been dissolved.

#### Northern Pacific.

Work progresses favorably on the Pacific Division, from Kalama northward, the chief work just now being the ballasting of the 25 miles completed and grading. Contracts for ties have been let at 21½ cents each. Two passenger locomotives, shipped from San Francisco for Kalama, were to arrive last month.

#### North Pacific Coast.

Marin County, Cal., has voted to subscribe \$160,000 in aid of this railroad from Saucelito through San Rafael, Olema and Tomales, and thence up the coast to Wahulla River, a distance of 90 miles.

#### Vicksburg & Natchez.

The organization of this company was recently completed. The incorporators are William T. Martin, Wm. F. Mellen, George W. Green, H. R. Revels, H. H. Harris, J. C. Webber, Joseph Baszinsky, George F. Ring, George F. Brown, William McCary and George W. Walton.

#### Natchez & New Orleans.

The incorporators of this newly organized Mississippi company are George W. Green, J. W. Young, John Robson, S. M. Preston, A. T. Bowie, W. F. Mellen, R. W. Fitzhugh, N. L. Carpenter, W. B. Spencer, S. H. Lambdin, H. P. Jacobs, John Rawle, Robert H. Wood, H. H. Harris and A. K. Farrar.

#### Meridian, Red River & Texas.

Wilkinson County, Miss., has voted to subscribe \$400,000 to this company.

#### Atlantic & Gulf.

At the annual meeting of this company, recently held in Savannah, the President reported the gross earnings, year ending January 1, 1872:

From freight.....	\$791,280 66
From passage.....	217,505 62
From mails.....	21,720 00
From incidental sources.....	14,161 70
Total.....	\$1,044,667 98

or an increase over the previous year of \$12,696.97, notwithstanding the diminution of cotton transportation. The earnings of the first six months increased \$98,484.08, but the last six decreased \$85,787.11, thus reducing increase to figures first named.

#### Cairo & Vincennes.

The Shawneetown (Ill.) *Mercury* of the 22d ult. says: "Work has been commenced in earnest on the whole line of the Cairo & Vincennes Railroad. Gen. Raum and Dr. Mitchell have undertaken the clearing, grading and tying of nineteen miles of the road west of Harrisburg." Winslow & Wilson, the chief contractors, report that they have purchased all the iron for the road, will have 50 miles of track laid by June and 100 miles by August.

#### Kansas City Union Depot.

It is reported that representatives of all the railroads having depots in Kansas City have conferred together concerning the construction of a great passenger depot for their common use, and that six of the seven were agreed in favor of it.

#### Chicago & Northwestern.

The engineers surveying for the proposed Lodi & Milwaukee Branch of this road have located a line from Milwaukee via Wauwatosa, Granville, Merton, Alderly, Neosho, Iron Ridge, Juneau, Oak Grove, Lowell and Danville to Lodi.

#### Buffalo, New York & Philadelphia.

This company will receive proposals until the 15th inst. for the completion of its road ready for the superstructure from the Pennsylvania line south of Olean to a junction with the Philadelphia & Erie Railroad at Emporium, a distance of about 45 miles. Proposals may be made for a part or the whole of the work. The company's office is at No. 62 Exchange street, Buffalo.

#### Milwaukee & St. Paul.

This company is now running passenger trains through between Milwaukee and St. Paul by way of La Crosse, Winona, and the St. Paul & Chicago road, using the Northwestern's La Crosse, Trempealeau & Prescott road between La Crosse and Winona. By this route the distance is but 323 miles, whereas by way of Prairie du Chien, the old route, it is 406 miles.

#### Cairo & Fulton.

Ex-Senator Thayer, of Nebraska, and O. J. Averell, of New York, Commissioners appointed by the Secretary of the Interior to examine the Cairo & Fulton Railroad in Arkansas, report favorably on the work so far as done.

#### Chesapeake & Ohio.

One of the engineers writes to us from Coalsburg, W. Va., under date of the 26th ult.: "The passenger trains will commence running to this place on Monday, the 4th of March. Heretofore trains have only run between Huntington and Charleston, a distance of 51 miles. This place is 16 miles above Charleston on the Kanawha River."

#### Des Moines & Winterset.

The last rail was laid on this line on the 28th ult.

#### Blue Ridge Railroad.

The South Carolina Legislature has passed a bill to cancel \$4,000,000 of the bonds of this company indorsed by the State.

#### Port Huron & Lake Michigan.

The bonds of this company bear the guarantee of the Great Western Railway Company to apply a certain portion of the proceeds of the traffic received from this road for the purchase of the bonds at a price not above par. It is now announced that up to the close of 1871 it has set apart \$4,902.64 for that purpose, and it invites proposals for the sale to it of bonds to that amount.

#### Memphis, Little Rock & Pacific.

This is the name of the company formed by the consolidation of the Memphis & Little Rock and the Little Rock & Fort Smith railroad companies, which was ratified on the 28th ult. at a meeting in Little Rock. The new company, it is reported, has executed a lease to the Southern Security Company, to take effect January 1, 1873, at which time the line is to be complete from Memphis to Fort Smith, about 350 miles. The directors are: Samuel Tate, C. G. Scott, A. McDonald, H. L. Bunkly, W. N. Farrington, Henry Page, A. T. Lacy, B. D. Williams and John Stoddard.

In announcing the consolidation of the Memphis & Little Rock and the Little Rock & Fort Smith companies, by which the above company was formed, the Little Rock *Republican* of the 24th ult. has the following concerning the probable future course of the property:

"Mr. Scott, on behalf of the Southern Railway Security Company, of which he is the controlling spirit, is to have a lease of the two roads for ninety-nine years from January 1, 1873. The stockholders of the Memphis & Charleston road have ratified the lease of that important highway to Mr. Scott for the same period. The first mortgage bonds issued by the Fort Smith road, amounting to about three and a half million dollars, and the same character of bonds of the Memphis road, are to be retired, and bonds of the consolidated railway issued in their stead. The Fort Smith road and the Devall's Bluff and Pine Bluff branch of the Memphis road are to be built and put in first-class condition by the first of January next, when the lease commences.

"For the purpose of raising means to do this, the first-mortgage bonds of the consolidated company are to be issued, indorsed by the Southern Security Company, which will make them as good in the money markets of the world as all first-class securities.

"It is the intention of Mr. Scott, who was recently elected President of the Texas Pacific Railroad, to push forward the Memphis & Shreveport road from Pine Bluff, and the Texas Pacific to the neighborhood of Albuquerque. At the same time the Fort Smith road will be built into the Indian country, there connecting with the Atlantic & Pacific, and following the line of the thirty-fifth parallel until reaching the point where the Texas Pacific crosses this route (near Albuquerque), where a junction of the two roads will be formed and one line be formed from there to the Pacific.

"This consolidation will insure the completion of an unbroken railroad to the Indian Territory, a distance of 283 miles, before the close of the year 1873. As a corollary from this consolidation will be the building of the branch road to Pine Bluff and thence to Shreveport and Jefferson City."

#### Cairo & Fulton.

The Little Rock *Gazette* reports Mr. Thomas Allen, the President of this company, as saying: "If the people and counties south of Little Rock will give this company what you say you 'would almost guarantee,' viz.: '\$500,000 in county bonds and a million acres of land,' I will extend the Cairo & Fulton Railroad, and have the cars running thereon from Little Rock to Fulton, on the Red River, within twelve months from that date, probably in less time."

#### St. Joseph & Denver City.

The engineers have recently completed the location of this road across Southern Nebraska to Kearney, on the Union Pacific Railroad. The route is described as follows:

"From Hanover, Kansas, it runs up the valley of the Blue to Big Sandy; thence from the mouth of this stream up at a distance of twenty-five miles; from thence it takes the ridge between the Little Blue and Big Sandy,

and follows it until it strikes the Platte Valley twelve miles this side of Kearney; it then follows the Platte to the terminus. The maximum grade of the road from Hanover is twenty-five feet to the mile, and the average grade from five to eight feet per mile. The last seventy-five miles of the route is nearly a perfect air line, and will make one of the best tracks in the United States, and from Hanover to Meridian the route is an excellent one, with few curves and light grades."

The contractors were to commence work on the extension last week.

#### Cincinnati & Springfield Air Line.

The Cincinnati *Commercial* of the 26th ult. says: "The work of laying the ties and steel rails on the Springfield Short Line Railroad, north from its junction with the Marietta & Cincinnati Railroad, at Ludlow Grove, has commenced, and the execution of the contract will be a matter of only a very short time. The ties are being rapidly distributed all along the line of the road, and with the exception of the difficulty of procuring the right of way through the Longview Asylum grounds, there are no serious obstacles to the progress of the work. Cars from the Baltimore & Ohio Railroad are being used for the transportation of ties and iron, and there is a large quantity of material already on hand delivered at the junction."

#### Quincy, Missouri & Pacific.

Tracklaying is resumed beyond La Belle, a steamboat load of iron which has been lying at St. Louis during the winter being forwarded by rail.

#### Cincinnati, Sandusky & Cleveland.

This company, it is reported, will soon construct repair shops and a round-house at Springfield, O.

#### Denver & Rio Grande.

The grading and bridging of a division 43 miles long, from Colorado Spring southward, is reported completed.

#### Davenport & St. Paul.

A line has been surveyed for the extension of this road from Lime Springs, Iowa, on the Milwaukee & St. Paul road five miles south of the Minnesota line, northwestward to Kasson, on the Winona & St. Peter road 16 miles west of Rochester, as well as the line to Rochester.

#### Kalamazoo, Lowell & Hastings.

Surveys for this line are nearly completed, and, if sufficient subscriptions can be secured in Kalamazoo, the work will soon be put under contract.

#### Missouri, Iowa & Nebraska.

The Alexandria *Commercial* reports that there is iron for 15 miles of line belonging to this company and waiting for the opening of the Mississippi to arrive at Alexandria.

#### Winona & St. Peter.

The extension from St. Peter to New Ulm was formally opened for business on the 1st inst. and trains now run through between Winona and New Ulm, a distance of 198½ miles. There is as yet but one station, Oshawa, between St. Peter and New Ulm, and that is 8 miles from St. Peter and 22 miles from New Ulm.

#### Chicago & Michigan Lake Shore.

This railroad is now completed to Pentwater, Mich., 165 miles north of Battle Creek and 20 miles north of the late terminus at Montague.

#### Oreston & St. Joseph.

This railroad, extending from Creston on the Burlington & Missouri Railroad southwest through Bedford, Iowa, to Hopkins, the northern terminus of the Maryville Branch of the Kansas City, St. Joseph & Council Bluffs Railroad, is now fully opened, and the first through passenger train passed over it on the 26th ult. It completes a new and tolerably short route between Chicago and St. Joseph, entirely over "Joy" roads.

#### Ashtabula & Jamestown Branch.

This railroad was completed by the laying of the track into Jefferson on the 24th ult. This line extends from the Lake Shore & Michigan Southern Railway at Ashtabula, O., southeast 45 miles to Jamestown, Pa., where it connects with the Jamestown & Franklin Railroad, which extends 51 miles further east to Oil City, as well as with the Erie & Pittsburgh road. The new road and the Jamestown & Franklin road are controlled and operated by the Lake Shore & Michigan Southern Company, and together form a branch of its main line to the oil regions, exceedingly well adapted for carrying oil westward.

#### Utah Central.

The General Freight and Ticket Agent, Mr. D. O. Calder, makes a statement of the earnings of this road, which extends from Ogden to Salt Lake City, 37 miles. The total for 1871 is \$338,792.38, and for 1870, \$136,005.51, showing an increase in 1871 of \$202,786.87, or nearly 150 per cent. These earnings are larger than those of most railroads west of Chicago, being at the rate of \$9,156 per mile of road, which for a line only two years completed should be extremely satisfactory. The tonnage for the year amounted to 68,900 tons, the largest item being merchandise (14,700 tons), coal and wood (14,692 tons), lumber (12,268 tons) and ore (11,117 tons). An increase in the rates of freight on ores over the Union Pacific put an end to that traffic on the 1st of August, and in December by the blockade of the Union Pacific all traffic was reduced, the receipts in that month being little more than one half the November receipts.

#### Missouri River, Fort Scott & Gulf.

There are now two passenger trains daily running between Kansas City and Baxter Springs over this road, and one between Kansas City and Les Oygnes, 61½ miles, besides the two trains of the Kansas City & Santa Fe road which use the part of the road between Kansas City and Olathe. There are three freight trains between Kansas City and Fort Scott, 98 miles, one freight between Fort Scott and Baxter, 61 miles, and two coal trains between Fort Scott and Godfrey, 6 miles. The through passenger trains leave Kansas City at 9:50 a. m. and 12 at midnight, and reach Baxter at 6:20 p. m. and 8:42 a. m., respectively, the distance being 159 miles.



## Prices of Rails in February.

Bigelow & Johnston, of No. 48 Pine street, New York, report the following prices current of rails for February:

	Gold.	Currency.	Import, Tons.
<i>New Rails.</i>			
English.....	\$65 @ 65½		1,461
American.....	\$75 @ —		
Total import this month.			1,461
Import since January 1.			8,296
Total to date.....			9,757
Same time 1871.....			14,640
<i>Old Rails.</i>			
Double heads.....	\$46½ @ 47		
T or Flange.....	\$46 @ 46½		
U or Bridge.....	Nominal.		2,545
Total import this month.			2,545
Import since January 1.			4,163
Total to date.....			6,708
Same time 1871.....			6,512

"*New Rails.*"—Buyers, becoming convinced that further delay was only making their position worse, have entered the market freely, and in consequence prices have made another material rise. We do not, however, keep up to the level of the English market, the cost of importation being above even our advanced quotations. American rails have also shared the general buoyancy and are about \$2 per ton higher. Great caution is manifested in making engagements for delivery very far ahead, as the continuous scarcity and dearth of raw material make it a matter of absolute necessity that manufactured iron should bring yet higher figures.

"*Old Rails.*"—The market for this class of material has shown great animation, bordering on excitement. The heavy advance abroad and rumors of scarcity have enabled holders to realize a great increase on the prices ruling a month ago. Nothing but the difficulty of getting forge irons at anything like reasonable figures justifies so great an advance, which equals in extent since 1st of January the whole increase in the gold price since 1867 till then. At present there seems little prospect of any decline. So far our supply at this port has been fully up to that of 1871."

They report also a rise in scrap iron of nearly \$10 per ton since January, to \$50 @ \$52.50 for No. 1 wrought, and an advance of \$4 to \$5 per ton on American pig.

## New Bridge at Quincy.

Articles of incorporation of the "North Missouri & Quincy Bridge Company" have been filed in the office of the Secretary of State of Missouri. It contemplates the construction of a railroad and wagon bridge across the Mississippi at Quincy. The directors named are Edward McCabe, of Marion County, Mo., and John Wood, Thomas Jasper, Thomas Redmond, George Adams, Charles H. Bull, Caleb M. Pomeroy, George S. King, Charles A. Savage, John H. Schermerhorn, J. G. Rowland, James D. Morgan and Daniel Paulin, of Quincy.

## Bessemer Works in Indianapolis.

A company of wealthy iron men, including W. O. Lockwood, M. Lord, A. Jones and John Thomas, has been formed for the purpose of establishing Bessemer works in Indianapolis.

## Railroad Policy of Ontario.

The Ontario Government have brought down a series of resolutions defining their railway policy. It is proposed to add a sum of \$400,000 to the railway fund set apart by the act of last session, and to be applied in accordance with the provisions of that statute. In further aid of railways a sum of one hundred thousand dollars yearly for twenty years is to be set apart out of the consolidated revenue fund, so as to form a fund to be known as the "Railway Subsidy Fund." It is provided that no railway of which any section is aided from the railway fund shall receive any aid in respect of such section from the "Railway Subsidy Fund." Aid from this new fund is only to be given where the company applying shall have complied with all the conditions of the former act. By the seventh resolution the extent to which any line may be subsidized is limited as follows: "That the sum to be granted to any railway company out of the railway subsidy fund shall not be less than \$120 or more than \$240 per mile per annum for twenty years." It is further provided by the eighth resolution, "That scrip or certificates may be issued in respect of any grant out of the railway subsidy fund after payment thereof has been duly authorized." The plan of aiding railways by subsidies as proposed is neither novel nor untried. As compared with a direct money grant in a lump sum, certain advantages are claimed for it. Spreading the grants over a series of years has the effect of greatly lessening the immediate demands on the Treasury, while not restricting the extent of aid which it may be advisable to give. In this way a larger sum will be left at the disposal of the Government for distribution to the municipalities, in adjusting the municipal loan fund according to the scheme which is presumed to be in contemplation. It is fully apparent that the railways are to be dealt with by the present Government in a spirit not less liberal than that displayed in the measures of the late administration. This is very satisfactory; we believe there is the most entire unanimity of opinion in Ontario as to the wisdom of a liberal railway policy.—*Canadian Monetary Times.*

## Riveted Joints.

At a meeting of the Institution of Mechanical Engineers held at Birmingham on the 25th ult., a paper was read "On the Strength and Proportions of Riveted Joints," with the results of some recent experiments, by Mr. Walter Browne, of Bristol. In this paper four different modes of fracture possible in riveted joints were described, consisting in—shearing of the rivet—crippling of the plate, or elongation of the rivet hole in the line of strain—fracture of the metal between the rivet hole and the edge of the plate, in the line of strain—or tearing of the plate along the line of the rivet holes, at right angles to the line of

strain. From the consideration that a perfect joint would be one offering equal resistance of each of these modes of fracture, the proper proportions were deduced for the various descriptions of riveted joints, with the aid of data furnished by different experiments previously recorded, and by a series of experiments recently made for the purpose by the writer. The proportions thus obtained for single-riveted lap joints are that the diameter of the rivets should be twice the thickness of plate, and the pitch of the rivets and the width of the lap should each be three times the diameter of the rivets. For double-riveted lap-joints, the diameter of the rivets being again double the thickness of plate, the pitch should be 4½ diameters, and the width of the lap should be 5½ diameters in chain riveting and 6 diameters in zigzag riveting. For butt-joints with a single cover-strap the proportions are the same as for lap-joints; and with double cover-plates, the thickness of each strip being only half that of the plates, the diameter of the rivets should be 1½ times the thickness of plate, and in single-riveted joints the pitch should be 3½ diameters, and the width of the cover-plates 6 diameters; in double-riveting, the pitch should be 5 diameters, and the width of the cover-plates 11 diameters in chain riveting and 12 diameters in zigzag riveting. A calculation of the proportionate strength of these different joints, as compared with the strength of the solid plates themselves, shows that but little advantage is obtained by the employment of butt-joints in place of lap-joints, so far as mere strength of joint is concerned; and even in the best instance the strength of a double-riveted butt-joint with two cover-plates and drilled holes is less than four-fifths of that of the plate, while in common single-riveted lap-joints with punched rivet holes the strength is little more than half that of the plate, thus involving practically a serious waste of material. In the case of cylindrical boilers, constructed with the ordinary longitudinal and transverse joints of the plates, the strain produced upon the longitudinal joints by the internal pressure of steam is double that upon the transverse circular joints; and two modes of remedying this inequality in the strength of the joints have been adopted. The first consists in arranging the joints diagonally, in spiral lines round the boiler, whereby the effective strength of the joints and the boiler is increased in the ratio of four to five. In the other plan the boiler plates are rolled with thickened edges along the longitudinal joints, by which means, and by double-riveting the longitudinal joints, the strength of the joints is brought up very nearly to that of the solid plates themselves, without the necessity either of butt-jointing or of drilling the rivet holes; the thickened edges have also the advantage of obviating the ordinary corrosion occurring at the joints, which is so fruitful a source of boiler explosions. The importance of the subject investigated in the paper is sufficiently shown by the serious consequences which have arisen from defective construction of joints, both in boiler work and in iron shipbuilding.—*Engineering.*

## Report of the Maine Central Railroad.

The annual report of this company for the year 1871 was made at the stockholders' meeting, in Waterville, Me., on the 28th ult. The following abstract of the report we take from the *Boston Advertiser*:

The company is congratulated on the prospect that, the system having now been developed and brought into harmonious action, the stockholders may realize some substantial recompense for their investments and their long and patient waiting. The history of the union of the several interests is told in a few words. The principal results anticipated from union have been reached. Uniformity of gauge has been attained—our rolling stock has been reduced to a common standard, and by the construction of about twenty miles of new road, we can now pass freely, with the same cars and engines, over every part of our road, and run our trains without interruption, by night and by day, from Bangor to Boston. The general condition of the road has been much improved, and it is now equipped with sufficient motive power and rolling stock of as good character as can be found on any road in the country. After a recital of the circumstances under which the several leases (which have now been ratified) were entered into, the directors say:

Our system now consists of:

Maine Central.....	110 miles.
Portland & Kennebec.....	110 "
Newport & Dexter.....	14 "
Belfast & Moosehead Lake.....	33 "
Androscoggin.....	33 "
Leeds & Farmington.....	38 "
Maine Central Extension.....	19 "
Total.....	357

The entire interest-bearing debt of the company, including the stock of the Portland & Kennebec Railroad Company, the stock scrip of the Maine Central Railroad, and the bonds of the Maine Central and the Portland & Kennebec, Somerset & Kennebec, Androscoggin and Leeds & Farmington Railroads, and also all outstanding notes and bills, payable December 31, 1871, is \$7,989,014, being \$22,350 per mile of road. Add to this the capital stock of the road, \$3,434,520, and the whole amount will be \$11,423,534, or \$32,000 per mile for the road, and an equipment of 59 locomotive engines, 73 passenger and baggage cars, 860 freight cars, 74 station houses, and a liberal supply of materials of all kinds for operating a railroad.

The Legislature at its present session has authorized a consolidated loan sufficient in amount to retire all the outstanding debts and liabilities of the corporation which we now operate, and to put the whole line with its equipment in safe and efficient condition. This loan will present a perfectly safe and most desirable security for capitalists, and will enable the company to concentrate all its liabilities in bonds issued by special legislative authority, and based upon the most ample security. We recommend the acceptance of the act referred to, with authority to the directors to issue bonds sufficient in amount to meet all the contingencies contemplated by that act, and to secure the same by mortgage. With these provisions carried into effect, the financial condition of the road will be placed upon a solid and permanent basis.

The number of miles run by engines during the year has been 934,585, of which 418,026 were connected with passenger trains, and 326,786 with freight, and 189,773 with construction, wood and other miscellaneous trains.

The total earnings for 1871 (which include earnings of Androscoggin and Leeds & Farmington roads for six months, and Belfast & Moosehead Lake road for eight months only) have been \$1,566,210.25, of which \$696,913.68 were for passengers, \$795,921.71 for freight, \$70,600.80 for mails, express-car use, etc., and \$2,744.06 for rents and other miscellaneous items.

The amount of ordinary operating expenses has been \$1,094,638.97. We have also paid out in expenses incident to change of gauge, permanent improvements and in damage occasioned principally by the calamity at Hampden bridge and by the collisions at Farmington and Freeport, the sum of \$115,455. The cost per mile run has been \$1.19 34-100; or, if we include the extraordinary expenses above referred to, \$1.29 38-100.

The whole number of passengers transported has been 584,507, showing a combined travel of 20,932,599 one mile. The average distance traveled by each passenger was 36 miles; the earnings from passengers per mile have been \$1.66 7-10; the average price per mile for passengers is three and one-third (34) cents. The whole number of tons of freight transported has been 314,902.05, at an average of \$2.52-100 per mile, or 3 8-10 cents per ton per mile.

The relations with connecting roads are represented to be satisfactory. The arrangement with the Eastern road is referred to, and in terms of evident gratification. The directors deplore the rupture of relations between the Eastern and the Boston & Maine roads, and say, in italics, that the addition of another road between Berwick and Portland will impose an additional cost and expense that must and ultimately will be made a charge upon the business of Maine. "We hope, however," they say, in concluding consideration of this subject, "that when the managers of the Boston & Maine road shall have completed their new line, we shall be able to make permanent running arrangements with them which shall be mutually beneficial and satisfactory." The European & North American and the Knox & Lincoln roads are already important feeders of the Maine & Central.

The balance sheet of the company, prepared by the Treasurer, Mr. J. S. Cushing, shows the following facts:

Receipts from passengers.....	\$696,913 68
" " freight.....	795,921 71
" " mails.....	30,569 46
" " express, etc.....	40,031 34
Total.....	\$1,563,436 19
Maintenance of way.....	\$413,586 58
Fuel and repairs.....	199,209 60
Train expenses.....	329,165 63
Station expenses.....	128,614 19
Miscellaneous.....	63,569 56
Total.....	\$1,094,638 97
Net earnings.....	\$468,797 22
The dividends paid amount to.....	\$52,313 52
And interest and taxes to.....	363,716 22
Total.....	\$415,929 74

Among the extraordinary expenses during the year were \$546,732.86 in improvements and extension of the road from Danville to Cumberland, which latter item cost \$486,178.06. There were bonds to the amount of \$716,646.90 paid during the year, all these unusual expenses being met by new loans. The statement of liabilities shows in detail the amounts due on the several loans, which are given in the aggregate in the directors' report. A comparison of the figures for the year 1871 with those of the year 1870 shows an increase in every item. This will appear from the following table:

	1871.	1870.
Number of passengers.....	584,507	580,328
Tons of freight.....	314,902	313,818
Receipts from passengers.....	\$696,914	\$617,254
" " freight.....	795,922	669,885
" " mails.....	30,569	27,456
Total receipts.....	\$1,563,436	\$1,349,510

At the stockholders' meeting the leases of the Belfast & Moosehead Lake Railroad and of the Androscoggin Railroad, with the assigned lease of the Leeds & Farmington road, were ratified. The recent act of the Legislature authorizing the Maine Central to make a consolidated loan by mortgage of its entire owned and leased line, was accepted, and the directors were authorized to issue such bonds of the company to an amount sufficient to cover the entire indebtedness of the company—thus converting all its debts into a debt of one class. The re-election of the old board of directors by a unanimous vote completed the business of the meeting.

## CHICAGO &amp; ALTON RAILROAD.

## Directors' Ninth Annual Report.

To the Stockholders of the Chicago & Alton Railroad Company: The Board of Directors submit the following report of the company's affairs and its operations during the year ending December 31, 1871:

	CAPITAL STOCK.
Common.....	\$8,929,900
Preferred.....	2,445,400
Total.....	\$11,375,300
	FUNDED DEBT.
Preferred sinking fund bonds.....	\$256,000
First mortgage bonds.....	2,383,000
Income bonds.....	1,067,000
Total.....	\$3,706,000
First and second mortgage bonds issued by the St. Louis, Jacksonville & Chicago Railroad on line between Roodhouse and Louisiana, payment of principal and interest assumed by this company, as per terms of sale.....	732,000
Total.....	\$15,813,300

	EARNINGS.
From passenger traffic.....	\$1,273,793 44
From freight traffic.....	3,740,204 07
From express companies.....	84,949 42
From transportation of mails.....	74,050 54
From miscellaneous sources.....	105,913 76
Total.....	\$5,778,910 23

	EXPENSES.
For conducting transportation.....	\$722,632 30
For motive power.....	829,898 56
For maintenance of way.....	976,819 18
For maintenance of cars.....	300,163 02
For general expenses.....	138,523 74
For taxes, State, county and municipal.....	117,737 97
Total.....	\$3,085,874 77

Net earnings.....\$2,693,035 46

	INCOME.
Balance at credit of this account, January 1, 1871.....	\$285,238 48
Net receipts, as above stated.....	2,198,085 46
Total.....	\$2,483,323 94

	DISBURSEMENTS.
Interest on bonds of all classes.....	\$295,610 00
Paid sinking funds.....	72,000 00
Rental paid Joliet & Chicago Railroad Company, exclusive of sinking fund.....	136,489 32
Rental paid St. Louis, Jacksonville & Chicago Railroad Company.....	240,000 00
Rental paid Louisiana & Missouri River Railroad Company.....	11,645 00
Dividends Nos. 16 and 17.....	1,135,005 00
Government tax on dividends, &c.....	21,492 80
Cost of improvements charged this account.....	121,525 93
Total.....	\$2,062,268 15

Balance December 31, 1871.....\$446,955 81

The gross receipts from traffic exceed those of the preceding year \$429,505.34, or about nine per cent. The net receipts show an increase of \$134,786.42, or six and a half per cent.

The operating expenses of your lines (exclusive of taxes) amount to 56.13 per cent. of gross receipts; including taxes, 58.36 per cent. During 1870 the operating expenses were 54.11 and 57.40 per cent. respectively.

The increased ratio of operating expenses in 1871 is due largely to exceptional causes. In March the depot buildings and engine house at East St. Louis were destroyed and considerable damage was done to other property of the company by a tornado. In October Chicago was visited by a terrible conflagration, from which your company suffered a loss in buildings and property destroyed, not covered by insurance, of about one hundred thousand dollars. The cost of repairs and replacements rendered necessary in each case is charged in the account of operating expense.



The receipts from passenger traffic are \$18,391.49 less than in 1870. The number of passengers transported during the year was 715,662, a decrease of 16,869, or 2.3-10 per cent., compared with the preceding year. Of the whole 94.6-10 per cent. traveled between local stations, and 5.4-10 per cent. were through passengers.

The average sum paid by each passenger, including through and local, was \$1.78.

The number of pieces of baggage entrusted to the agents of the company by passengers, during the year, was 168,856, or about 450 per day. The amount of claims for lost, stolen and damaged baggage, during the year, was only \$178.40.

We are happy to be able to add, that in no case during the year did any injury occur to a passenger upon your trains.

So many new lines of railway have been built during the last three years, intersecting and crossing your lines, that we now have competition at all important stations, but such is the character and basis of your traffic, that it is gratifying to be able to report an increased tonnage of freight transported in 1871 over 1870 of 19 per cent., the aggregate being 2,522,064,279 lbs. in 1870, and 3,002,991,752 lbs. in 1871. The proportion between through and local freights being 10.46 per cent. of the former to 89.54 per cent. of the latter.

The aggregate receipts from freight traffic show an increase of \$428,135.34, or about 13 per cent.

The coal traffic upon your lines continues to increase. It commenced in 1865 with only 6,000 tons. It has increased to 318,324 tons in 1870, and 381,936 tons in 1871, or nearly 13 per cent. during 1871.

Your property has been, in all departments, fully maintained in first-class condition. Two thousand two hundred tons of steel rails, 5,300 tons of new and re-rolled iron rails, 1,800 tons of repaired rails, and 199,268 new cross-ties have been used in repairs and replacement of materials in the tracks.

Five and one-quarter miles of new side-tracks and nine miles of double-track have been added during the year.

Experience proves that it is good policy to substitute steel rails in the place of iron rails, where a heavy traffic occurs, and about twenty-five miles of steel rails will be laid during the present year.

The number of locomotives owned by your company at the close of the year is 125. Fifteen were purchased at the Schenectady Locomotive Works, and two built at the shops of the company, during the year. One hundred and eleven are "coal-burners" and fourteen "wood-burners."

The whole number of miles run by locomotives during the year was 3,359,997, or at the rate of 28,000 miles per annum for each engine.

The cost of motive power per mile run, compared with 1870, is as follows:

	REPAIRS.	WAGES.	FUEL.	OIL AND WASTE.	CLEANING ETC.	TOTAL.
1870..	6.76 cts.	6.61 cts.	8.85 cts.	0.96 cts.	1.25 cts.	24.43-100 cts.
1871..	6.45 "	6.51 "	8. "	0.85 "	1.26 "	23.10-100 "

Showing a reduction of 1.33 cents per mile.

The number of miles run to a cord of wood was 41 in 1870, and 45 in 1871. The amount of coal consumed per mile run was the same in each year, being 40 miles run for each ton.

The traffic of the present year will require an additional number of engines and cars. Twenty engines have been ordered for delivery during April, May and June.

Four first-class passenger coaches, 94 house cars, 105 combination freight and seven drivers' cars, have been added by construction at the shops of the company during the year. The number and description of cars upon your lines, at its close, may be stated as follows:

Pullman palace sleeping cars.....	12
Pullman dining cars.....	5
Passenger cars.....	51
Baggage and mail cars.....	14
Express cars.....	8
Combination freight cars.....	105
House freight cars.....	1,414
Stock freight cars.....	297
Drivers' cars.....	7
Platform cars.....	639
Tool and wrecking cars.....	5
Paymaster's car.....	1
Total.....	2,558

The condition of both engines and cars has been fully maintained, with the exception of 113 cars burned at Chicago during the great fire of Oct. 9. Other cars are in process of construction to replace those destroyed.

The following summary, taken from the accounts relating to the mileage of cars, etc., will be found of interest:

Aggregate number of miles run by Chicago & Alton cars, exclusive of construction trains.....	27,586,527
Average of each car.....	11,740
Miles run by loaded cars on Chicago & Alton Railroad.....	19,470,695
Miles run by empty cars on Chicago & Alton Railroad.....	6,601,370

Total miles run..... 26,470,695

Ratio of loaded to empty cars, about 3 to 1.

Miles run by Chicago & Alton cars on other roads..... 4,418,377

Received for use of Chicago & Alton cars on other roads..... \$66,221.92

Miles run by "foreign" cars on Chicago & Alton Railroad..... 3,302,445

Paid for use of "foreign" cars on Chicago & Alton Railroad..... \$45,401.39

Difference in "foreign" mileage in favor of Chicago & Alton Railroad..... 1,115,832

Difference in mileage account with other lines in favor of Chicago & Alton Railroad..... \$20,830.53

Average earnings for mileage of each C. & A. "Blue Line" car..... 364.53

At the commencement of the year this company was operating 511 miles of railway, as follows:

Chicago to Joliet (under perpetual lease).....	33 miles.
Joliet to East St. Louis (owned by your company).....	243 "
Dwight to Washington, with branch to Lacon (owned by your company).....	80 "
Bloomington to Godfrey—St. Louis, Jacksonville & Chicago Railroad (under perpetual lease).....	151 "

Total..... 511 miles.

During the year it has constructed, and now owns, a line from Roodhouse, a point on the St. Louis, Jacksonville & Chicago road, to a point on the east bank of the Mississippi River opposite Louisiana, in Missouri, a distance of 37.6-10 miles.

This line has been constructed in a very substantial manner, including an iron bridge, 1,200 feet in length (with a draw for the passage of boats), at the Illinois River.

It has been constructed upon the financial basis set forth in our last annual report, at a cost of \$1,217,097. The franchise was obtained through the St. Louis, Jacksonville & Chicago Railroad Company, without cost to your company, and under the terms of the contract that company has issued its first mortgage bonds at the rate of \$5,000 per mile, and its second mortgage bonds at the rate of \$5,000 per mile, to aid in providing a construction fund. The payment of the principal and interest of these bonds is assumed by your company.

Under the terms of the contract and lease agreed upon and executed by your company and the Louisiana & Missouri River Railroad Company, as set forth in our last report, 51 miles of the lines of that company have been completed, from Louisiana to Mexico. Your company has also purchased a steam ferryboat, with capacity for transferring an entire passenger train, or twelve freight cars, across the Mississippi River at one time.

These lines (from Roodhouse to Mexico) were opened for through traffic on the 30th day of October last, making an aggregate of 599.6-10 miles operated by our company during the last two months of the year.

The work of preparing the road-bed for the iron on the lines of the Louisiana & Missouri River Railroad Company, from Mexico west, and from Mexico southwest to Jefferson City, has not been prosecuted as rapidly by that company as its contract requires. Track-laying is now in progress on the latter line, and will be completed to Jefferson City early in the spring. It is due to the officers of that company to state that the delay on their part has been occasioned by unexpected financial difficulties which, it is hoped, they will soon be able to surmount.

The line from Roodhouse to Mexico forms a connection between the lines heretofore controlled by your company and the St. Louis, Kansas City & Northern Railway (formerly North Missouri), and the co-operation of that company with yours enables us to form a through line between Chicago and Kansas City shorter than any other in operation.

Our experience during the few weeks that the through line has been in operation has not been sufficient to form a very reliable basis for estimating future traffic, as the Mississippi River from Cairo northward has been for a considerable part of the time obstructed by ice, so as to render the transfer of cars impracticable by ferry. We are, however, confident in the belief that the traffic of the "Louisiana Through Line" will be fully equal to our previous anticipations.

The operation of the several lines purchased and those leased continues to show, in each case, by direct returns from traffic, and in many other ways, the importance of your control over them.

The attention of stockholders is called to the accompanying report of the Secretary and Treasurer, showing the several accounts of the company in detail.

In conclusion, the board desire to acknowledge the efficient manner in which the business of the company has been conducted by its officers and agents during the past year.

By order of the board,

T. B. BLACKSTONE, President.

Chicago, February 14, 1872.

### The Detroit & Milwaukee Railroad Report.

The following summary of the annual report of the directors of the Detroit & Milwaukee Railroad Company for the year 1871 we take from the Detroit Tribune:

The total bonded debt of the company amounts to \$10,213,527.75.

The gross traffic and rents for the year, exclusive of the Lake Michigan proportion, were \$1,507,217.74, an increase of \$86,095.11 over those of 1870.

The working expenses, taxes and insurance were \$941,583.88, being \$23,684.41 more than in 1870.

The net revenue amounted to \$565,633.86, being \$62,410.70 more than in 1870; which, after paying interest, etc., leaves a total net revenue account of \$333,699.08.

The payments of interests on bonds and discounts amount to \$396,943.44, and the payments for taxes and insurance to \$37,901.95.

The road carried 440,239 passengers during the year, with receipts from passenger travel of \$618,178.42. The freight (including live stock) carried amounts to 377,769 tons, the receipts amounting to \$801,407.94. This shows a falling off in the number of passengers, and a large increase in the amount of freight, as compared with the preceding year. The Superintendent says:

"The local passenger decrease may partly be accounted for by the operation of new lines running parallel to and across the line of this company, but other causes appear to have produced a diminution in the intermediate local travel. The through passenger traffic, never very large, shows an increase of about 10 per cent. in earnings. The freight traffic shows an increase of 10 per cent. on local and 7½ per cent. on through tonnage, but the average rate per ton on both continues to yield less than that of preceding years."

For ballasting, grading, paving, etc., the total expenditure for the year is \$21,268.07. The total expense of the locomotive department during the year has been \$210,769.41, and the total cost of fuel was \$78,174.75.

The car stock of the company consists of 30 first-class cars, 20 post-office and baggage cars, 7 emigrant cars, 330 box and cattle cars, 188 flat cars and one auxiliary car.

The Engineer reports a total expenditure upon new works of \$9,917.23, and upon maintenance and renewals of permanent way of \$322,734.45.

The amount expended on bridging has been \$26,047.91 less than the previous year. Eighty-six thousand four hundred and twenty-one ties or sleepers have been put in the track, being 47,862 more than last year. Also, 2,688 tons re-rolled rails—513 tons more than in 1870; 10,977 rails have been repaired by a sawge block at a cost of \$12,648.53.

An extra expenditure in fencing was caused by the fires which swept over this State on the 8th, 9th and 10th of October last, burning over 50 miles of single fence, about one-half of which has been rebuilt with a substantial rail fence. The remaining portion will be entirely renewed before the 1st of April next.

### Report of the South Carolina Railroad.

The South Carolina Railroad Company owns a line of railroad of 5-foot gauge from Charleston, S. C., northwest to Hamburg (on the Savannah River, opposite Augusta, Ga.), with a branch from Branchville, 62 miles from Charleston, north to Kingsville and thence northwest to Columbia, S. C., 68 miles, and a branch of the latter branch from Kingsville, 43 miles north of Branchville, north to Camden, 38 miles. It has thus a total mileage of 243 miles of line. It is the main connection of Charleston with the interior, connecting as it does with the Georgia Railroad at Augusta, and with the railroads to the "up-country" of South Carolina at Columbia.

The annual meeting of stockholders of this road was held in Charleston, S. C., on Thursday, February 15. The income of the company, as represented in the statements accompanying the report, appeared as follows, viz.:

Earnings of road.....	\$1,323,442.00
Expenses of road (66½ per cent.).....	879,858.63
Balance of earnings.....	\$443,583.37
Add received from dividends on bonds and stocks.....	19,807.98
Balance of income.....	\$463,391.35

Against this have been charged

For interest sterling.....	75,897.31
For interest domestic.....	276,119.02
Dividend No. 44 (1 per cent.).....	58,194.00

The balance transferred to profit and loss..... \$409,710.33

The earnings of the road, as compared with those of last year, show a falling off of..... 146,578.59

The expenses show a reduction of..... 36,237.19

The President says the bond and general indebtedness remain without material change from the report twelve months since. The issues and retirements of bonds during the year are very nearly equal, leaving the account substantially unchanged. The bills payable show a considerable increase, in comparison with the outstandings, at same date, in 1870, amounting to \$452,581.34, and is accounted for by the Treasurer as follows:

Purchase of Macon & Augusta Railroad Company stock.....	\$550,000.00
To retire due and past due bonds and interest.....	46,700.00
To provide for sterling interest and fractional balances in exchange of sterling bonds.....	52,760.00
To retire certificates of indebtedness.....	9,985.00
To meet dividends, declared prior to 1871.....	56,300.00
Vedict in cases Gilbert and Central Railroad Company, cost and professional services.....	19,500.00
Loans for general purposes.....	17,406.34

Total..... \$452,581.34

During the past year there have been brought to Charleston by the South Carolina Railroad, 262,701 bales of cotton, as against 33,536 for the year 1865, and largely in increase of any year since the close of hostilities. And so with the number of passengers. There were in 1871 197,362, as against 93,528 in 1865, showing a steady and progressive increase. During this whole period the road has been replaced, and permanently added to in value, in equipments, cars and construction.

The capital account of the company is at the rate of \$42,190 per mile of road, but it owns railroad, steamship and bank stock to the amount of \$1,240,000, or more than \$5,000 per mile. The gross earnings for the last year were \$5,454 per mile; the net earnings \$1,820 per mile.

### LOCOMOTIVE STATISTICS.

FOR THE MONTH OF AUGUST, 1871.

NAME OF ROAD.	No. of Locomotives in service.	MILEAGE.	NUMBER OF MILES RUN TO	COST PER MILE IN CENTS.							AVERAGE COST OF		
				Passenger.	Freight.	Miscellaneous.	Total.	Coal.	Oil.	Repairs.	Fuel.	Stoves.	Miscellaneous.
Allegheny Valley.....	132	40	34,840	57,306	6,640	98,986	40.40	31.62	6.50	4.73	.70	7.16	19.09
Burlington & Mo. River.....	450	63	47,333	73,663	54,966	175,662	42.04	63.85	19.20	4.93	8.31	.81	7.45
Illinois Central.....	1109	181	132,318	308,724	67,638	506,671	37.93	14.66	8.08	5.94	.62	6.51	21.15

FOR THE MONTH OF SEPTEMBER, 1871.

Allegheny Valley.....	132	30	34,481	58,232	6,384	99,096	40.44	34.31	6.26	4.72	.66	6.99	18.63
Burlington & Mo. River.....	450	62	40,080	77,835	56,524	174,379	37.74	58.50	12.80	3.6	9.2	.8	7.0
Central Pacific.....	1019	143	96,199	183,865	71,549	351,073	47.34	40.79	13.69	11.05	15.86	1.0	6.65
Illinois Central.....	1109	186	129,429	330,707	73,857	524,993	35.47	14.47	7.81	6.37	.50	5.63	20.41
Pitts., Ft. Wayne & Chicago (Eastern Division).....	319	144	78,758	284,045	11,683	374,486	40.75	.....	3.92	5.14	.80	1.52	6.63

FOR THE MONTH OF OCTOBER, 1871.

Allegheny Valley.....	132	38	34,835	59,089	7,910	101,834	39.54	.....	31.04	7.35	5.68	.70	7.20
Burlington & Mo. River.....	450	60	40,825	76,746	54,373	171,744	38.18	69.29	12.47	3.84	9.15	.80	7.56
Pitts., Ft. Wayne & Chicago (Eastern Division).....	319	141	72,982	287,683	9,147	376,112	39.73	.....	3.94	5.42	.76	1.60	6.56

FOR THE MONTH OF NOVEMBER, 1871.

Allegheny Valley.....	132	39	35,185	54,573	9,040	99,797	33.36	.....	29.7	6.16	5.65	.72	7.42
Burlington & Mo. River.....	450	59	41,432	78,416	47,841	167,689	37.40	66.6	14.13	4.40	9.34	.81	7.31

FOR THE MONTH OF DECEMBER, 1871.

Burlington & Mo. River.....	450	61	40,409	70,939	38,775	150,123	32.21	54.68	11.78	4.66	10.49	.84	5.35
Pitts., Ft. Wayne & Chicago (Eastern Division).....	319	140	80,006	291,190	9,635	381,751	40.70	.....	15.29	8.82	6.15	.78	1.79
Pitts., Ft. Wayne & Chicago (Little Miami Division).....	42	.....	59,775	48,706	4,055	102,486	33.5	.....	13.1	5.6	10.1	.9	8.2